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Elevated, Midway, and Subway Gating

Using Three-Part Flasks on Two-Part Work to Increase Production—Arrangement of Gates and Runners—Abandoning the Horn Gate

By WILLIAM H. PARRY

ADVOCATING the use of three-part flasks in the making of castings usually molded in a two-part flask would appear, on first thought, an absurd proposition.

There are conditions, however, constantly cropping up in the foundry industry that are puzzling the most expert mechanics, and among them is the rapid production of sound castings, particularly on pressure work.

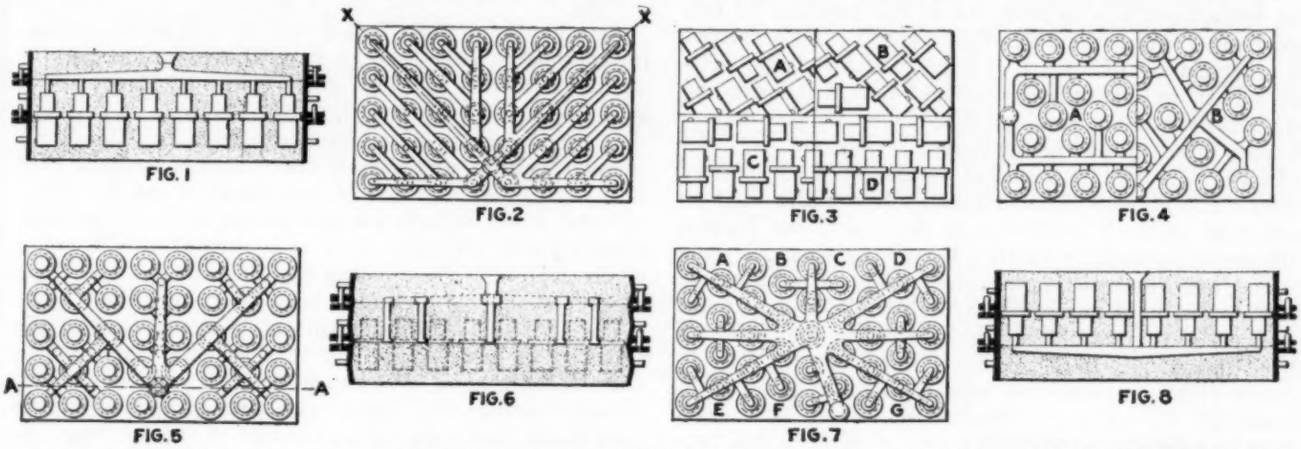


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5 FIG. 6 FIG. 7 FIG. 8

FIG. 1. STAGGERED SECTION OF THREE-PART MOLD SHOWN IN FIG. 2. FIG. 2. PLAN OF MOLD SHOWN IN FIG. 1. FIG. 3. QUARTERED LAYOUT SHOWING DIFFERENT ARRANGEMENTS OF SAME PATTERN. FIG. 4. HALVED LAYOUT SHOWING RUNNERS AND GATES USUALLY USED. FIG. 5. LAYOUT OF MIDWAY GATING WITH ELEVATED RUNNER. FIG. 6. SECTION OF MOLD SHOWN IN FIG. 5. FIG. 7. BAD LAYOUT OF RUNNERS. FIG. 8. HOW SUBWAY POURING CAN BE MADE EFFICIENT WITHOUT USE OF HORN GATE

In these days of the almost universal use of production pattern-plates, either mounted on molding machines or not, it is not an unusual happening to find that such plates do not always produce as many good castings as the number of patterns on them would indicate, in fact in many instances not one good casting has been found among the great number cast.

It is not claimed here that improper gating is the cause of these conditions in all cases, but there is no question but what it enters into a very large percentage of lost casting totals.

In designing production pattern plates it is not always good policy to crowd as many patterns into the confines of the flask spaces as possible, with the idea in mind of greater production, as very ofter the reverse is the result.

Again, the number of plate patterns is restricted to the spaces not occupied by the one, two, three, or four runners plus the necessary connecting gates that, as any experienced mechanic will testify, take up very valuable space which could be utilized for more patterns.

In Fig. 1 is shown a staggered section of a three-part mold assembled, showing the sprue and runner in the cope, the pop gates and the upper part of the castings in the cheek, and the lower part of the castings in the drag. Fig. 2 is a layout to show the position and number of patterns on the plate or plates and also to show the runners and gates. Fig. 1 is a sectional view of Fig. 2 on the lines *XX*.

It will be noted that this is an apparently simple two-part job, and it was so rigged at first, with gates attached to the flange and two runners running lengthwise. The castings were to stand 1,000 lb. pressure after being finished all over, and hundreds of thousands of them were needed badly. As every casting was porous, it was evident that some other method of gating must be tried to make production possible.

Pattern plates by the dozen were made, each embodying some new wrinkle thought out by the executive force—and they all failed. A mechanic not connected with the foundry force suggested the "three-high idea" as he called it, and was looked upon as being violently insane when he tried to explain how a two-part job could be better made in "three boxes" of sand. Nevertheless his scheme was tried and succeeded beyond his wildest hopes. Three plates were made, the one for the cope rigged with the runners and one half the sprue height, as shown in Figs. 1 and 2. The cheek plate accounted for the upper parts of the castings with pop gates attached to each and every one of the forty patterns, projecting upwards just high enough to come flush or a trifle under the flask height, and engaging with the runners at points shown in Fig. 2. The drag plate was mounted with the larger of the two hubs. The sprue was so placed that the inrushing metal did not pour directly into a casting cavity, while the runners

were designed to give the most direct passage to the metal. As tight flasks were used, it was possible to pour forty castings to each mold, and get them all sound. This was seventeen in excess of the number of patterns spaced on the two-part flask plates as originally designed, and from which not a single casting was free from porosity.

One very decided advantage in using the elevated runner method, is that no attention need be paid to the runner or gate positions in placing the patterns, other than to keep in mind that they must not be placed so that a staggered runner is necessary to engage with the pop gates, though a little variation from a straight line is not necessarily objectionable. Again this method lends itself to direct pouring into the cavities and in a measure provides a feeder to counteract gravity shrinkage in castings with heavy and deep sections on each side of a light flange. On the original two-part flask plates the gates engaged with the flange so that the metal flowed down, then up in the cope with the result that the upper hubs did not always fill and when they did, sponginess was to be found at the juncture of hub and flange. As to how far this method can be carried on other classes of work it is hard to state at this writing, but there is no reason to doubt that it will succeed on a wide variety of castings that cannot be cast on end because of conditions in the design.

In Fig. 3 at *A*, *B*, *C* and *D* are shown four quarter layouts of a similar piece on split pattern plates, half on each side, as the little boss near the end of the biggest hub prevents molding so that the pouring can be done on end, and illustrates how many patterns can be placed on plates without any attention being paid to gates and runners, as they would be provided for in the cope of a three high mold. If the mold was filled as at *A*, *C* or *D*, twenty-eight castings are possible, while if as at *B* twenty-six can be surely counted on, which is at least eight in excess of what could be expected from the two-part flask method. This well repays the extra labor of ramming up a shallow cope to form the elevated runner. Pop gates are not shown on these layouts, though they can be placed on either hubs or flanges, their positions being determined at times by the ease with which they can be separated from the casting, or all evidence of their presence destroyed in machining.

At Fig. 4 are two half layouts, *A* and *B*, showing the antiquated runners and gates usually employed to coax the metal into a two-part flask mold in an attempt to get sound castings.

Layout *A* provides for a maximum of thirty-four castings, with a first class chance of losing one-third of them, while layout *B* can be crowded a little more to account for thirty, with a fair chance for a 25 per cent loss, the estimated loss percentages being in favor of layout *B* because of the shorter run of the metal and the doubt ever present that some of the cavities as per the layout *A* being filled with anything more substantial than air. Fig. 5 is a layout of midway gating still using the elevated runner to feed the gates located in the cheek, and which are fed in turn from only sixteen uprights that project clear through the cheek, as shown in the section in Fig. 6. No great advantage is apparent in using this method except that it may fit in on work that must be poured into the midsection of the casting.

Fig. 6 is a section of Fig. 5 at *AA* and illustrating the possibility of feeding forty castings with but sixteen upright feeders. A rather dubious advantage, but may adapt itself to some classes of work. Fig. 7 will serve to illustrate just how bad a runner layout can be, in spite of all the virtues claimed for the elevated gating method.

It will be noted that forty-one casting are provided for in this layout by resorting to the checker-playing or staggered idea of crowding all patterns possible on a plate regardless of future consequences, yet with all the crowding there are seven waste spaces *A*, *B*, *C*, *D*, *E*, *F*, and *G* in evidence that would better be utilized, as is the case in Fig. 2 where forty castings is the sum total.

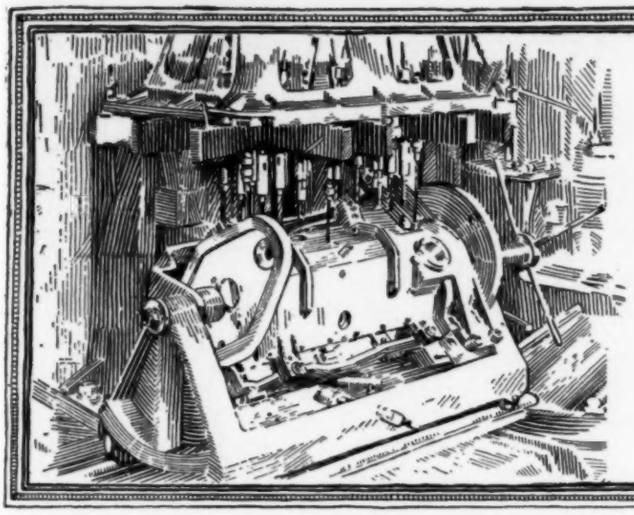
It will be noted also that at the junction of all the runners at the center there is a mass of metal that serves no good purpose and is apt to create serious trouble when cooling. Fig. 8 shows how bottom or subway pouring is made effective without horn gates, in fact it is no more expensive than ordinary every-day molding, yet is very effective on pressure work.

Note how the sprue passes through the cope and cheek feeding the runners, gates and forty castings just as easy as the old-fashioned horn gate used to feed one casting.

As a matter of fact, it is easier by this subway pouring method to make forty, yes, or a hundred castings as against one with the horn gate. This would appear to be a rather wild statement, but on analysis it develops that the handling of a loose horn gate to place it in correct position, and keep it there, means molding skill of a high order and lots of time while doing it. Next in order is the delicate job of drawing it out of the sand cleanly which also takes time and while all this is going on the man with the molding machine and a dozen flasks has rammed them up and is ready for a pour off.

Many of the readers of this article may scoff at the temerity in giving publicity to a scheme that involves the ramming up of an extra flask, be it ever so shallow, to pour castings that are usually made or spoiled in two-part flasks, and I am not unmindful of the fact that the adoption of this system means increased flask equipment with its attendant cost, but true economy begins in the foundry when first class equipment only is used if the maximum in the production of sound castings is desired. It will be noted that no mention is made as to the use of risers as part of any of the three proposed methods, as that is left to individual tastes, though a closer study of the subway pouring system as shown at Fig. 8 would seem to indicate that risers from each and every casting would insure better work. Another objection that may make prospective users of the methods shown hesitate in adopting any of them, is the extra labor entailed in separating the castings from the gates and runners, but a little study discloses a very simple way, by first cutting through the runners and laying the castings on their sides to cut through the gates. This method of course, applies to non-ferrous castings, as when gray iron is the metal used, the castings can be knocked off in most cases.

It is not claimed that any or all of these gating methods will prove to be the panacea for all gating ills, but they will solve many gating problems that have puzzled the best of experts. In conclusion, it is but fair to state that snap molds cannot be expected to give the results that tight flask molds will, as the binding qualities of stiff metal flasks permit the placing of more patterns on a plate with a greater factor of pressure-resisting safety, than could possibly result from snap molds even when jackets or bands are used to stiffen them.



Tool Engineering

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Milling Fixtures Continued—Design and Operation of Indexing Fixtures — Semi-Automatic and Automatic Indexing Devices—Uses of Twin Fixtures—Fixtures for Continuous Milling

MANUFACTURING conditions frequently make it necessary to design indexing or continuous milling fixtures in order to obtain maximum production. There are many factors which influence the design of such fixtures, consequently the tool designer must be continually on the watch for parts which can be handled to advantage in this manner. In analyzing the operations on a given piece of work to determine the kinds of fixtures to be used, the following points should be considered: (1) Production required; does it justify the use of multiple holding fixtures for continuous milling? (2) Shape and general outline of work. If work is of such shape that pieces cannot be set up close enough together to permit continuous cutter action, it will not pay to make up fixtures for continuous milling. A piece of work which is to be milled at both ends and which cannot be conveniently re-set, may sometimes be placed in an indexing fixture in such a way that one end may be milled and the fixture indexed to allow the other end to be machined without disturbing the setting of the work. Several examples of fixtures of this kind are given in this article. An indexing fixture may often be required when pieces are to be cut into two or more parts; for example, a ring casting which is to be cut up so that it will make three parts. (3) Surfaces to be machined. This item determines to a large extent the type of machine selected for the work, and the arrangement of the surfaces also influences the design of the fixture. (4) Cost of the fixture. This matter is an important one and should be determined by the production required, rapidity of operation and convenience of handling.

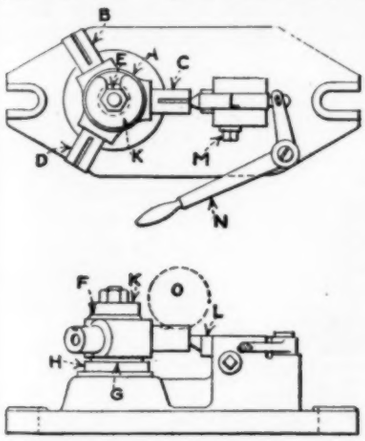

FIG. 144. SIMPLE INDEXING MILLING FIXTURE

There are so many points to be considered in connection with the design of indexing and continuous-machining fixtures that it is difficult to specify them in general notes, but they will be mentioned specifically in connection with the various designs of fixtures illustrated and described in this article.

Simple Index Milling Fixtures

In taking up index milling fixtures, the simpler forms are given first, gradually working up to those more complicated. Fig. 144 shows a "spider" *A* having three arms *B*, *C* and *D* which are to be grooved as indicated. The hole *E* and the faces *F* and *G* have been machined and the three arms have been centered and turned.

The work is located on the hardened stud *E*. The sliding point *L* is brought up so that it enters the centered end of the arm *C*, then the binder *M* and the nut on the C-washer *K* are tightened. The sliding point *L* is operated by the lever *N*. Attention is

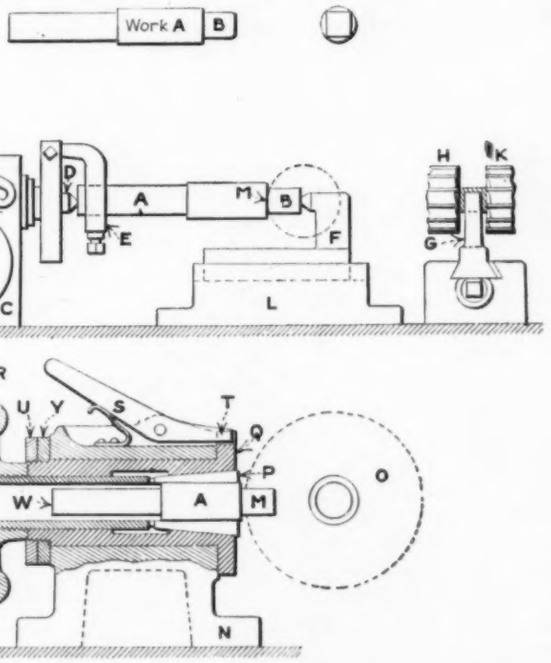

FIG. 145. FIXTURES FOR MILLING A SQUARE SHAFT

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called to the way in which the sliding point is cut away on its upper surface to give clearance for the center *O*.

It is necessary that the C-washer and the binder *M* be loosened when indexing from one position to the

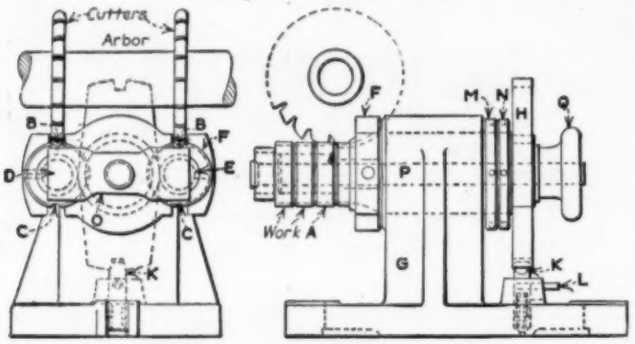


FIG. 146. TWIN INDEXING MILLING FIXTURE

other, but as this can be done rapidly and as the groove dimensions do not have to be particularly accurate, the results obtained are satisfactory.

Fixtures for Milling a Square Shaft

There are many cases in general manufacturing where a shaft is to be squared up at one end like the example *A* in Fig. 145. The portion *B* must be milled on four sides so that it will be perfectly square. This can be done in several ways, two of which are shown in the illustration. The index head *C* is used to obtain the correct relation of the sides of the shaft to each other while milling; the work being held on the center *D* and driven by means of the dog *E*. The other end of the work *B*, which is to be squared, is held on a special sliding center *F* which is made narrow as indicated at *G* in order that the cutters *H* and *K* may pass it without interference. The sliding point and the block *L* must be made to suit the local conditions. After two sides have been milled, the cutters are withdrawn while the work is indexed 90 deg. by means of the head *C*, after which the second cut is taken to complete the piece. If it is necessary that the shoulder at *M* be perfectly square the table must be fed in the direction indicated by the arrows.

Another example of an indexing milling fixture for the same piece of work is shown at *N*. This is a self-contained fixture which can be used with straddle mills as indicated at *O*, or with a single end milling cutter, or with two cutters arranged like those at *H* and *K*. The work is located in a spring collet *P* which is drawn back into the index sleeve *Q* by means of the handwheel *R*. The indexing is accomplished by means of the lever *S* which engages suitable slots in the edge of the index plate as shown at *T*. Attention is called to the method of adjusting the indexing member by means of threaded collars at *U* and *V*. This fixture will hold the work firmly. A permanent stop should be provided against the end of the shaft *W*, so that end location will not be affected by slight variations in the diameter of the work which might allow the collet *P* to be drawn into the chuck more or less thus causing variations in the position of the shoulders *M*.

This piece of work can also be handled in a fixture so designed that the work is held vertically to allow the cutters to pass completely by the portion to be squared up.

It is often possible to set up two or more pieces in an index milling fixture, thus increasing the production without extending the setting-up time any appreciable amount. In Fig. 146, the work *A* consists of collars which are to be grooved in two places as shown at *B* and *C*. Four pieces at a time are set up on each of the studs *D* and *E*, these studs being located in an indexing member *F*. This member has a bearing in the fixture base *G* and it is provided with a suitable index plate *H* as shown. A very simple method of indexing is used in this fixture, the pin *K* engaging an angular slot in the edge of the plate. The index plunger is disengaged by pressure on the pin *L*. Adjustment for wear is provided by means of the two nuts *M* and *N*. The work is clamped by means of the strap *O* through the action of the rod *P* operated by the hand knob *Q*.

The cutting action on these pieces is toward the solid portion of the fixture and as the cut is not very deep vibration of cutters and fixture is eliminated.

Index Fixture for Castellating Nuts

Ordinarily the manufacturer who uses a great number of castellated nuts buys these from some firm specializing in their manufacture. Occasionally, however, some special size is required which cannot be obtained from the manufacturer in the required time, so that it becomes necessary to design a special fixture for the purpose of castellating.

Fig. 147 shows a fixture of this kind in which the nuts *A*, *B*, *C* and *D* are held on one side of the fixture while the nuts *D*, *E*, *F* and *G* are loaded into the opposite side. The method of locating the work is clearly shown at *H*. The nut rests in a shallow V-block *K* and is clamped in position by means of the equalizing clamps *L* and *M*, which are operated by the same thumb-knob *N*. No indexing is provided for the three cuts on the nut as it is only necessary to loosen the knob *N* in order to release them so that they can be turned around by hand. The action of this device is not as rapid as some, yet it is capable of giving very good results and is sufficiently accurate for commercial work. A suitable indexing device must be provided for the different positions of the fixture. The method selected can be any one of several which have previously been described. A binder handle should be provided to hold the fixture firmly after indexing.

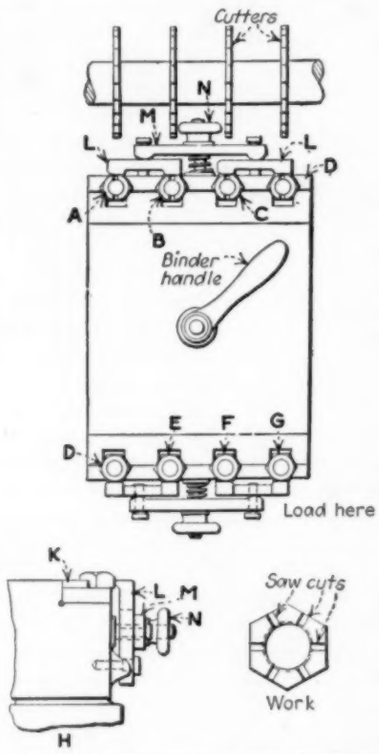


FIG. 147. INDEX FIXTURE FOR CASTELLATING NUTS

One of the principle uses of indexing fixtures is for cutting and splitting into segments various pieces

which have been machined in circular form in order to cheapen the cost of manufacture. An example of this kind is shown at *A* in Fig. 148. The work is a bronze ring about 12 in. in diameter which is turned up, bored, and faced before cutting into the three parts indicated at the points *B*, *C* and *D*. Five pieces are held at the same time on the arbor *D*, which is relieved so that the work only fits it for a short distance at the points where the cutting action is to take place. The lower ring locates on three hardened blocks *E* and all of the rings are clamped down by means of the three clamps *F*, *G* and *H*.

The clamps are slotted to allow the cutter to pass through them and they are located in a slotted plate so that they can be moved back when locating and removing the work. The indexing member *K* is provided with bushings at *L* to take care of the three indexing positions required. A simple type of index pin such as that shown at *M* is all that is required for correct indexing. The fixture is made quite heavy in order to absorb the vibration of the cut. This design taken as a whole will be found useful for many other operations of a similar nature, and it will be found that better results will be obtained by making it of rather heavy construction.

A fixture which is quite out of the ordinary is shown in Fig. 149. The work *A* is a splined transmission shaft which is so designed that the portion *B* indicated in the sectional view must be undercut between the various splines. This cut is not a heavy one, as the relief required is only a few thousandths, yet it is of great importance that it should be made rapidly and economically. The machine selected for this work is a Whitney hand milling machine having a weight feed to the head of the machine. The fixture base *B* is provided with an adjustable center *C* at one end with a binder at *D*. Adjustment is by means of the special screw *E*, clamping the shoulder *F* against the face of the V-block *G* in the indexing head. An adjustable V-block is provided at *H*, the adjustment being made by means of the screw *K* and a special socket wrench indicated by the dotted lines *L*. The sectional view *Q* shows the construction of this jaw. Both V-blocks are located in the index spindle *M* which is provided with an indexing mechanism similar to one which has been previously described. Suitable adjustments are provided to take up wear as indicated at *N*. The work is located for the first cut by means of a plunger *O* which makes a contact between the splines on the shaft. This locator is not used except when the work is first placed in the fixture. While the various operations are taking place the pin is pulled down and locked by means of the bayonet lock *P*.

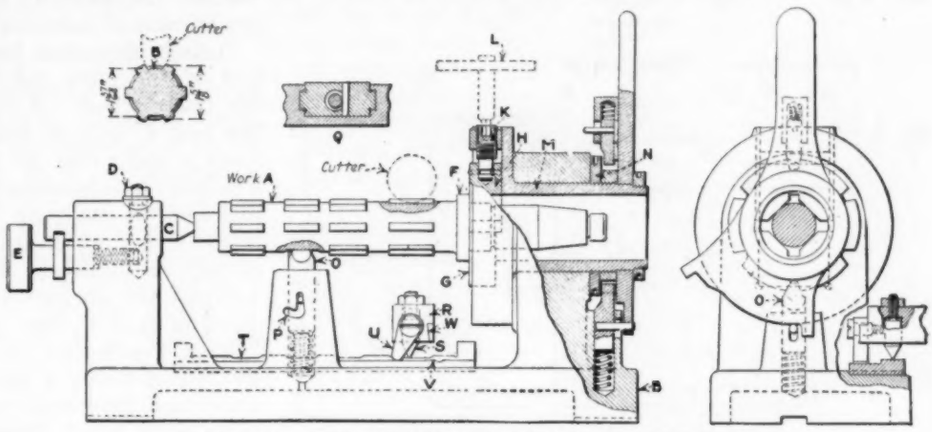


FIG. 149. SEMI-AUTOMATIC INDEXING FIXTURE

The sliding head of the machine is provided with a block *R* which has a follower point *S* so arranged that it will run along on the former plate *T* until the end of the work has been reached, when the swinging cam *U* strikes the recess *V*. This happens at the end of the cut and the moment the table feed is reversed the swinging point *U* strikes against the shoulder *W* and remains there during the reversal of the table thus causing the cutter to lift slightly away from the work so as to avoid interference.

A fixture of this kind is rapid in operation and will produce excellent results. The principles employed here can be used to advantage on other fixtures for similar work.

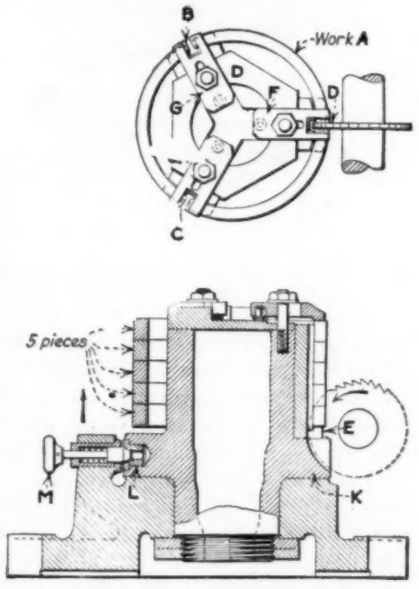


FIG. 148. INDEX FIXTURE FOR CUTTING BRONZE RINGS

Semi-Automatic Indexing Device

It is possible to design a fixture for a hand milling machine so that it will index automatically as the table travels backward and forward. One device of this kind is shown in Fig. 150. This mechanism consists of a fixture base *A*, shown in partial section, in which an indexing shaft *B* is mounted vertically. The upper part of this shaft passes through the fixture so that the work to be milled can be attached to it. It can easily be arranged so that it will operate a table of suitable diameter and the latter can be provided with clamps or locaters for the work.

It may be mentioned here that this mechanism is suitable only for work having a number of short radial cuts spaced from 10 to 20 deg. apart as the indexing movement obtainable is too small for indexing 45 or 90 deg.

The index wheel *C* is mounted on the vertical index shaft *B*, the notches being cut in accordance with the requirements of the work that is to be machined.

On some convenient portion of the machine such as the head, a bracket *D* is fastened, and through it passes the control rod *E* which is provided with adjustable locknuts at *F* and *G*. As the nuts *G* strike the bracket when the table is moving in the direction indicated by the arrow, the arm *H* is held in a fixed posi-

tion so that rod *K* pulls out the lock pin *M*, to which it is connected by the arm *L*. As the table continues to travel, the pawl *N* engages a tooth of the index

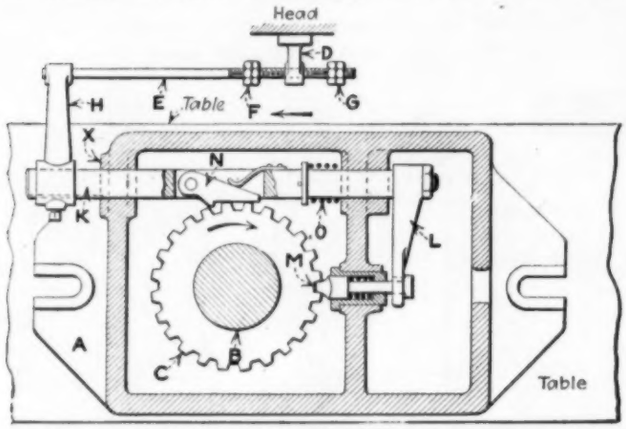


FIG. 150. SEMI-AUTOMATIC INDEXING DEVICE FOR HAND MILLING MACHINE

wheel and indexes the mechanism to a point determined by the adjustment of the arm *H* on the shaft. After the arm strikes the shoulder at *X* the operator reverses the table feed and the spring *O* returns the operating members to their normal position as shown.

The amount of movement which can be obtained on the index wheel *C* is somewhat limited, consequently care must be taken when designing a mechanism of this sort to be sure that the action of the pawl *N* is such that it will work properly. A very good point about this device is that all the working parts are concealed in the base of the fixture so that there is no chance for chips or dirt to clog it up and interfere with its working.

Automatic Indexing Device for Hand Milling Machines

A diagram of another mechanism having similar indexing features is shown in Fig. 151. These parts are indicated only in order to make clear the working of the mechanism, but the entire application is not specified. Let us assume that the index stud *A* is suitably mounted in a fixture and that the upper part of this stud is connected to the table on which the work is mounted. An index wheel is provided at *B* for a number of notches to correspond with the work which

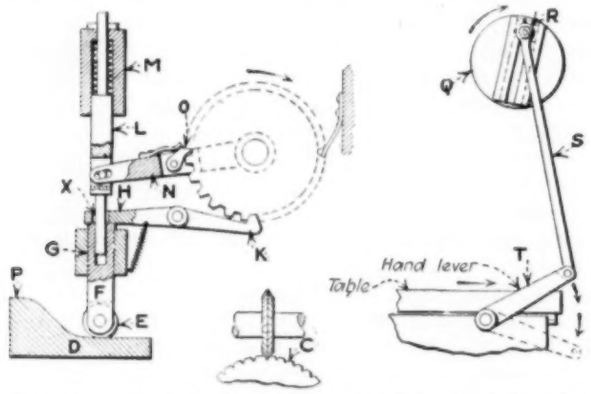
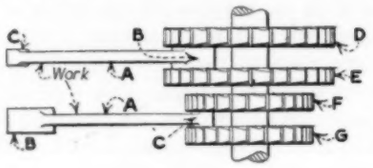


FIG. 151. AUTOMATIC INDEXING DEVICE FOR HAND MILLING MACHINE

is to be done. The index pawl lever *H* is so mounted that it is controlled by the sliding member *F* which has a bearing at *G*. The movement is controlled by the cam *D* which is fastened to a stationary portion of the machine. As the table travels in the direction indicated by the arrow, the roller rides up on the cam until it reaches the point *P*, the height of which determines the amount of indexing obtained.

It is evident that the lever *H* is first moved by the end of the push rod *F* until the portion *K* releases the index wheel. A continuation of the movement of the part *F* acts against the rod *L* and thus moves the lever *N* and turns the index wheel through the pawl *O*. The rod *L* is mounted so that it is a slide fit at *M* and also in the push rod *F*. Care must be taken to allow plenty of clearance in the hole *X* in order to permit the necessary movement. As the machine table returns, the springs force the push rod back against the cam until it rides once more in the position shown.

This mechanism can be operated automatically if desired by using a special countershaft above the machine and mounting on the end of this shaft a faceplate *Q* in which there is a slot as shown. The end of the rod *S* can be adjusted on the block *R* to give the proper amount of "throw" to the hand lever *T*.



The speed at which the countershaft is run must be very slow. A number of devices of this kind are in use and have been found to work out very satisfactorily for work which does not require very accurate indexing.

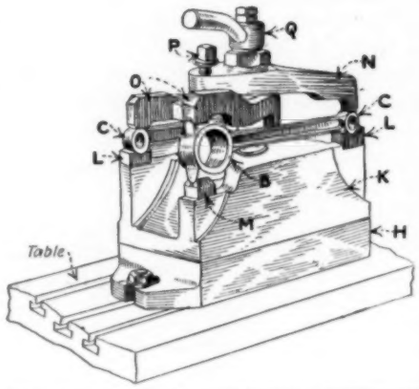


FIG. 152. DOUBLE INDEXING FIXTURE FOR CONNECTING ROD

When any kind of a double-end lever or a rod like a connecting rod is to be milled at both ends it is very often difficult to hold it properly, if a re-setting is necessary after one end has been milled. In the standard type of connecting rod for automobile motors, the subsequent operations are greatly helped if all the milling can be done without disturbing or re-setting the work. An excellent example of this kind is shown in Fig. 152. In the diagram work *A* is shown in position in order to illustrate the principles involved in the milling. The work is set so that the large end *B* and the small end *C* of the two connecting rods are at the same end of the fixture. The cutters *D* and *E* are spaced so that they will face both sides of the boss *B*, and the cutters *F* and *G* both sides of the boss *C*. The work is located on an indexing member *K* mounted on the base *H* and rests in V-blocks at *L* and *M*, as shown. The work is clamped by an equalizing device operated by the binder lever *Q*. The clamp *N* locks the ends of the rods *C* and *B*, while the other ends of the rods are held by the clamp *O*. The screw *P* is adjusted so that an equalizing action is obtained.

The table is fed into the cutters so as to mill oppo-

site ends of the two rods, after which the fixture *K* is indexed and the other end of the work milled. This fixture is an excellent design and is rigid, easily cleaned, and rapid in operation.

Double Indexing Fixture for a Forked Lever

A very difficult milling job is shown at *A* in Fig. 153. This is a double-end forked lever of irregular shape which would be difficult to hold and machine if an attempt were to be made to mill each end separately. The work is located in knife-edged V-blocks at *B* and *C* and it is also supported by a single V-block at the end *D*, while at the opposite side it rests on a corrugated surface *E*. A spring plunger *F* located at each side of the fixture forces the work into the locaters *B* and *C* while a special equalizing clamp *G* clamps the work down into the V-blocks and corrugated surfaces

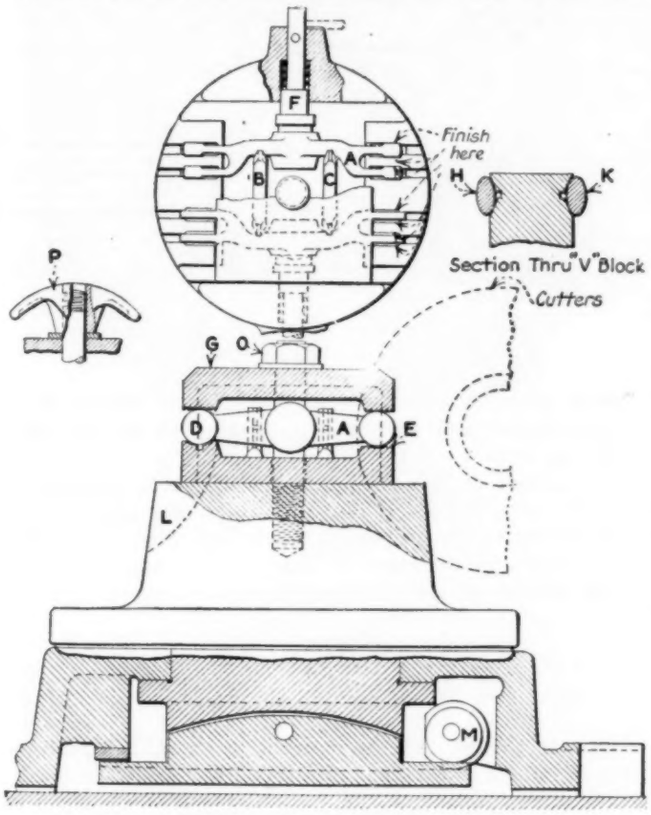


FIG. 153. DOUBLE INDEXING FIXTURE FOR A FORKED LEVER

at the ends of the piece. The shape of the levers at the portions where they locate in the knife-edge V-blocks is shown in the sectional view at *H* and *K*.

The entire locating device is mounted on the indexing table *L* and a mechanism for indexing and clamping is concealed in the base *M*. This indexing mechanism has been previously described and therefore requires no further mention. The clamp *G* can be operated either by the nut shown at *O* or by a hand knob *P*. In either case it is necessary to remove this completely when placing or removing work. Devices of this kind may be found useful for small levers which required milling operations similar to the one shown above in Fig. 153.

We have previously spoken of the necessity for continuous cutting action when making multiple fixtures. Unless this matter is carefully considered a continuous milling fixture may be made which will not be as economical as a much simpler and less expensive type of fixture.

Fig. 154 illustrates an economical method of setting up the work *A*, the pieces being set up alternately as indicated at *B* and *C* so that only one fixture is used for milling both sides of the work. By so doing the cutting action is very nearly continuous and the expense of an extra fixture is saved. Two revolutions of the table complete all the pieces on both sides. This idea may be used often and the advantages are evident.

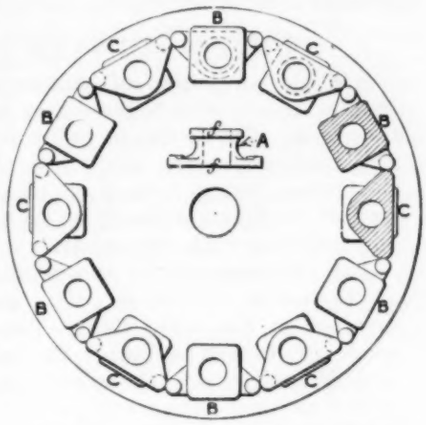


FIG. 154. ECONOMY IN LOCATING WORK FOR CONTINUOUS MILLING

It does not always pay to set up large work for circular continuous milling on account of the time wasted in "cutting air" if the pieces are not close to each other. An example of an excellent arrangement for continuous milling of cylinder heads is illustrated in Fig. 165. The work *A* is located on buttons and jacks as shown at *B* in the sectional view and is clamped against the hardened corrugated blocks *C* and *D* by means of the clamps *E*. The thrust of the cut is taken by the hardened pin at *F*.

The fixtures are made up in unit form as indicated at *G*, *H*, *K*, *L* and *M*, and are bolted to the circular table of the milling machine. This example of continuous milling is a very good one as it shows clearly that there is very little space between the pieces so that the cutting action is very nearly continuous. It

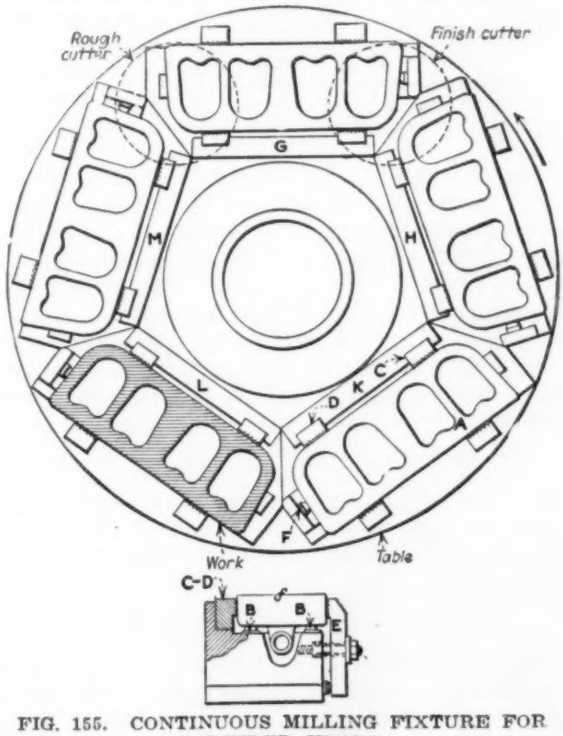


FIG. 155. CONTINUOUS MILLING FIXTURE FOR CYLINDER HEADS

can also be seen that the cuts are long enough to give the operator plenty of time to remove one cylinder head and replace another. In fact, it would probably be possible for one operator to handle two machines without great difficulty.

Serrating Fixture for Chuck Jaws

Another application of continuous milling is shown in Fig. 156, in which the cutter acts on the inside of the work. The operation requires a formed cutter as indicated at *A*. The chuck jaws *B* are set up around the fixture, being located on pins at *D* and *E*. The method of clamping should be such that the clamps will not interfere with the cutter.

The requirements for this work are that the inside of the jaw at *A* must be cut to a specified radius and serrated at the same time. This fixture gives very good results and although the cutting action is not entirely continuous, the pieces are set as closely together as their shape will permit so that in all probability no better arrangement can be made. The work can be set up easily and is produced within the required limits of accuracy.

Certain kinds of work permit its being set so closely together that economical production can be obtained by the use of continuous milling fixtures of circular form. An example of this kind is shown in the work *A* in Fig. 157. This piece is to be straddle milled and slotted at the points *B* and *C* as shown in the diagram. The nature of the work is such that the pieces can be set very closely together and clamped two at a time by means of a binder similar to that shown at *D*. This binder is so arranged that by tightening the nut at *E* the shanks *F* and *G* are clamped simultaneously and in a positive manner. The body of the fixture *H* is a simple ring of cast iron and is bolted to the circular table of the milling machine so that it forms a unit with it. It may be argued that the cutter action produces a large radius in the bottom of the slot which is to be milled, but even if this were the case it would not detract from the utility of the fixture. In reality the work *A* is a forging and the points *B* and *C* are relieved so that it is not necessary to cut the entire depth of the slot. This is clearly shown in the illustration.

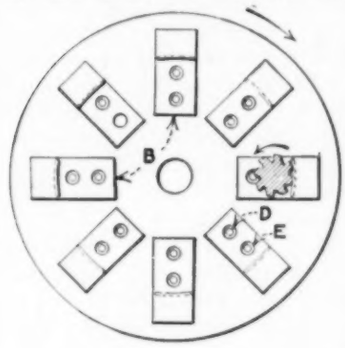


FIG. 156. SERRATING FIXTURE FOR CHUCK JAWS

Continuous Milling Fixture for Pump Body

Fig. 158 shows a very good arrangement of eight pieces for continuous circular milling of the part *A*. This piece is a small pump body which must be machined on the surface *B* in correct relation to the cylinders *C* and *D*. The work is set up in two knife-edge V-blocks as shown at *E* and the third point of support is obtained by means of a hardened stud *F* which makes the setting up of the work approach the ideal condition. The work is clamped by means of the equalizing clamps *G* and *H*, the clamps *G* resting on a support *K* at the outside of the fixture. Provision is made for removing the clamps by the slot *L*, which allows them to be pulled

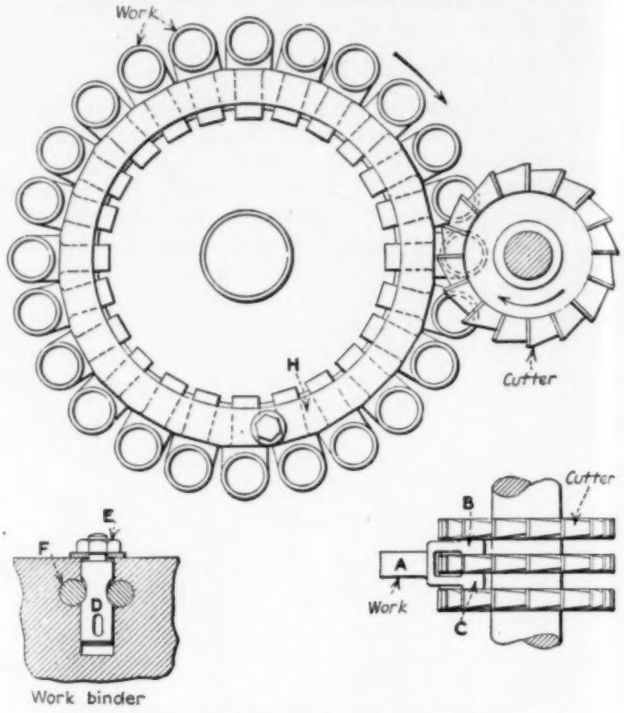


FIG. 157. CONTINUOUS SLOT AND STRADDLE MILLING FIXTURE

back in order to insert the work. The clamps *H* are also slotted and they rest in a ring *M* at the center of the fixture.

A glance at this design shows that it is symmetrical in its proportions, and while there is some time lost while the cutter is passing from one piece of work to the other, this amount is not great enough to restrict the utility of the fixture. Obviously, work having a

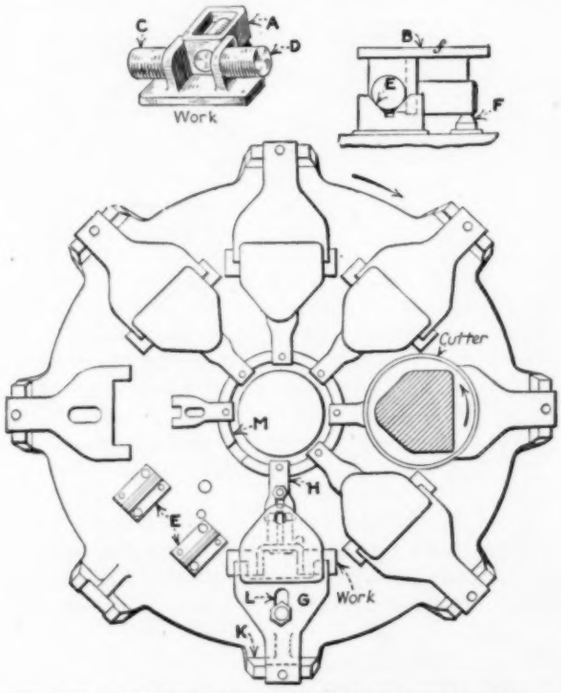


FIG. 158. CONTINUOUS MILLING FIXTURE FOR A PUMP BODY

shape like a "piece of pie," or in other words a wedge-shaped piece, usually lends itself readily to the design of a continuous circular milling fixture. Irregular pieces can occasionally be machined to advantage on fixtures of this kind, but often there is a great deal of time lost while the cutter is passing from one piece to another.

Fig. 159 shows a high-production continuous circular milling fixture which was used on a part of the Browning machine-gun tripod. This part is shown clearly in the detail drawing *A* and the portion to be machined is indicated at *B*. The work had been finished on the surface *C* in a previous operation, and the holes reamed so that the pins *D* could be used for locating. The work is clamped by means of the swinging leaf *E*, operated by the cam lever *F*. When removing the work from the fixture the lever stands in a vertical position and allows the clamp *E* to drop back against the surface *G*, thus giving plenty of clearance so that the work can be removed without difficulty.

Unit construction was used in designing this fixture and the blocks *H* are all made up so that they can be

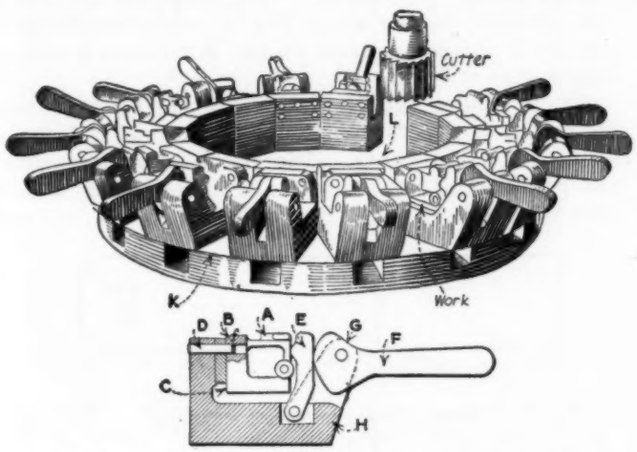


FIG. 159. CONTINUOUS CIRCULAR MILLING FIXTURE FOR A BRONZE CASTING

located one at a time on the circular plate *K*. In order to make the illustration perfectly clear one block has been left out at *L*.

In considering the design of this fixture the unit construction should be studied carefully, as its advantages are quite apparent. As a matter of fact, by using this arrangement two units were made up and used more than a month before the entire fixture was completed. Another point in favor of unit construction is the reduced cost of manufacture, as it is evident that small units can be made up and applied to the fixture much more easily than if they were actually a part of the fixture. Attention is called to the clamping lever and its rapid action. Not only is it powerful but it locates the work firmly and positively against the seat.

When work is to be milled on two opposite sides as in the example *A* shown in Fig. 160, maximum production can be obtained by setting the work up in series. In the case shown the machine used is a duplex milling machine having large inserted tooth cutters at *B* and *C* and the fixture is designed so that it will hold a number of pieces. Fixtures of this kind are usually made up in units in order that the base plates *H* may not be too difficult to handle when machining. The pieces are located on dowels at *D* and *E* and clamped down by means of heavy clamps at *F* and *G*. These clamps are made U-shape so that they can be removed quickly. The number of pieces which can be machined on a fixture of this sort depends entirely upon the length of the table and it is advisable to use the full length whenever possible in order that the machine may be run continuously for a considerable period of time. The operator is thus able to work two machines if they are conveniently placed so that he can pass from one to the other without loss of time.

After the work has passed by the cutters *B* and *C*, shown in the upper view, the operator can take off those castings which have been machined so that when the entire group of castings has been finished the table can be run back and a new casting placed in position, allowing the machine to be started again without long delay. Then while it is in operation, other castings can be removed and replaced with new ones. There are on the market a number of machines built especially for the continuous milling of heavy castings. One of these carries its fixtures similar to the arrangement shown in Fig. 160, while another machine has a circular action, the table revolving in a vertical plane. Although these machines are extremely useful for certain classes of production, the writers do not deem it necessary or essential to describe fixtures which should be used on them. The data which have been given here will enable an engineer to design suitable fixtures for machines of the character mentioned in case he is called upon to do so.

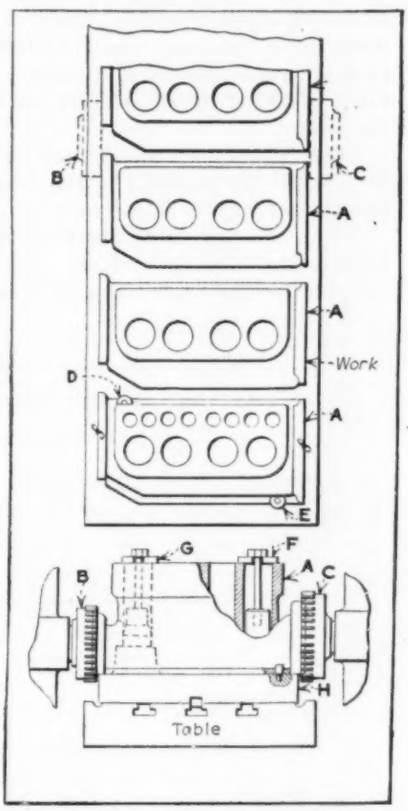
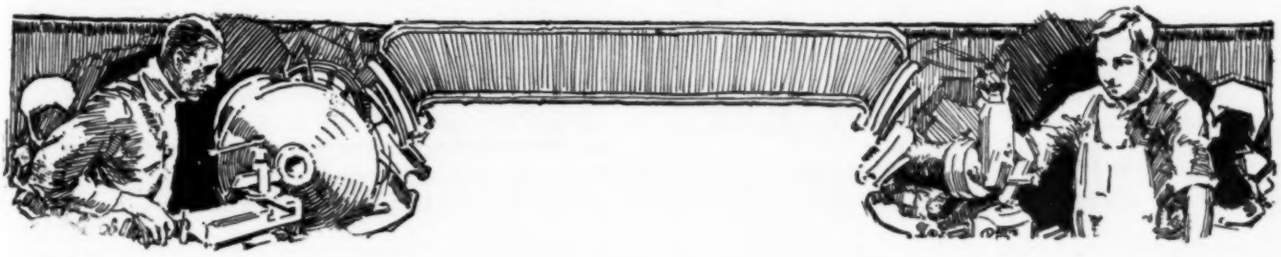


FIG. 160. CONTINUOUS MILLING FIXTURE FOR DUPLEX MILLING



Tools for Boring and Turning Locomotive Tires—I

Data on Sizes, Angles of Clearance and Rake of Tools Together with Speeds and Feeds Used by Seventeen Leading American Railroads

By FRED H. COLVIN
Editor, *American Machinist*

IN ORDER to ascertain the prevailing practice in tire boring and turning, questionnaires were sent to the leading railroads, the result of these inquiries forming the basis of this article. In the accompanying table is condensed information as to the tools used in tire boring as practiced by some of the leading railroads of the United States. The tabulated form followed does not permit of many details or variations from standard practice, and for this reason several notes have been appended to give such additional data as may be of interest and value. Illustrations are also given showing details of tire boring tools from different shops.

These notes are designated by numbers which correspond to the numbers in the table, making it unnecessary to refer to each railroad by name.

No. 1. Boring tools are the same as standard lathe tools, being interchangeable. The form of cutting edge and the angles are shown in Fig. 1. *A* and *B* show the large tool while *C* shows the cutter used in a toolholder. The tools *A* and *B* are made double ended at times, one end right-hand and the other left-hand. It should be noted that the clearance angle is given as 105 deg. but is equivalent to 15 deg. as usually measured. On the inserted tool *C*, the clearance is 30 deg. The top and side rake is 12 deg.—considerably more than usual in both cases, but giving a shearing cut in all directions. These tools are all high-speed steel.

No. 2. The boring tools are ground on a Sellers tool grinder using "Former B." The roughing tool has a ¾-in. straight face as at *A*, Fig. 2, while the finishing tool has a straight face of 1½ in. Both have a cutting edge radius of ¼ in.

No. 3. Fuller details of the tire boring tools used are shown in Fig. 3. The rough-boring tool *A* is interesting in several ways. The round nose, the curved top of the cutting lip and side rake, make a very free cutting tool. The finishing tool *B* has a flat nose

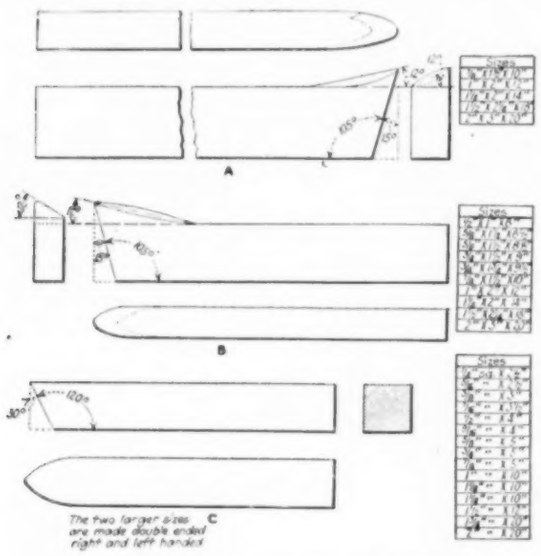


FIG. 1. ATCHISON, TOPEKA & SANTA FE

FIG. 2. CHICAGO AND ALTON

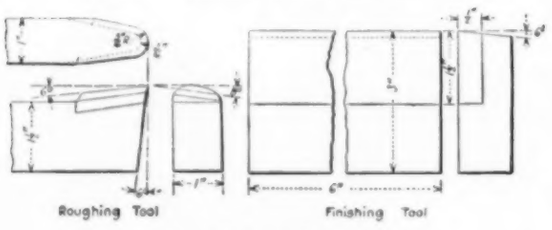


FIG. 4. CANADIAN PACIFIC

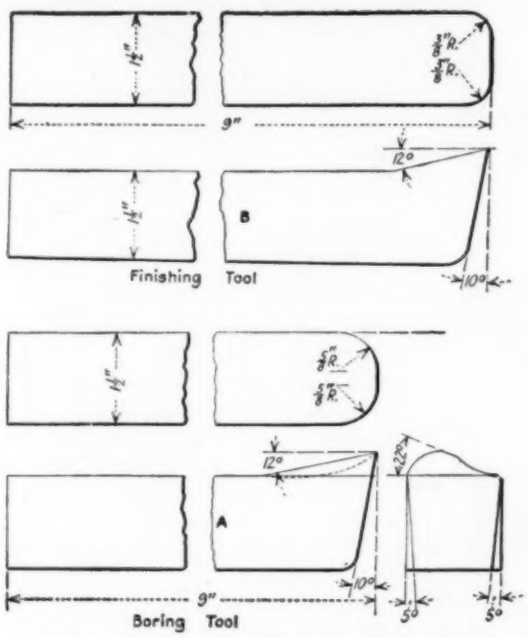


FIG. 3. CHICAGO AND NORTHWESTERN

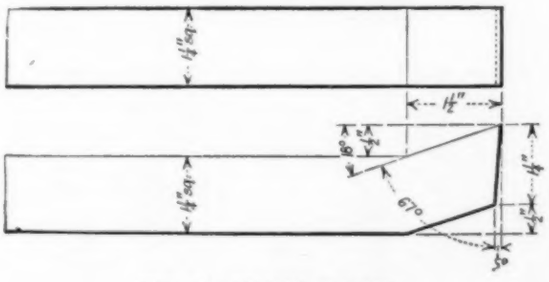


FIG. 5. GRAND TRUNK

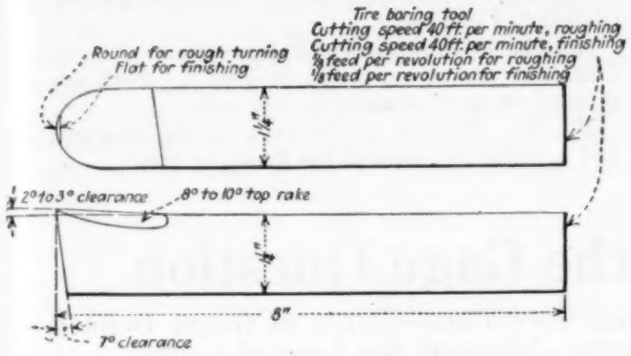

Tire boring tool
Cutting speed 40 ft. per minute, roughing
Cutting speed 40 ft. per minute, finishing
1/8 feed per revolution for roughing
1/16 feed per revolution for finishing
Round for rough turning
Flat for finishing
2° to 3° clearance
8° to 10° top rake
8"
7° clearance

FIG. 6. HOCKING VALLEY

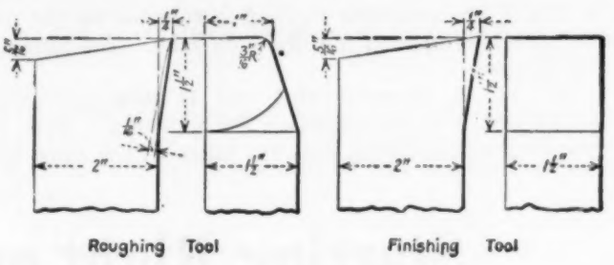


FIG. 7. LEHIGH VALLEY

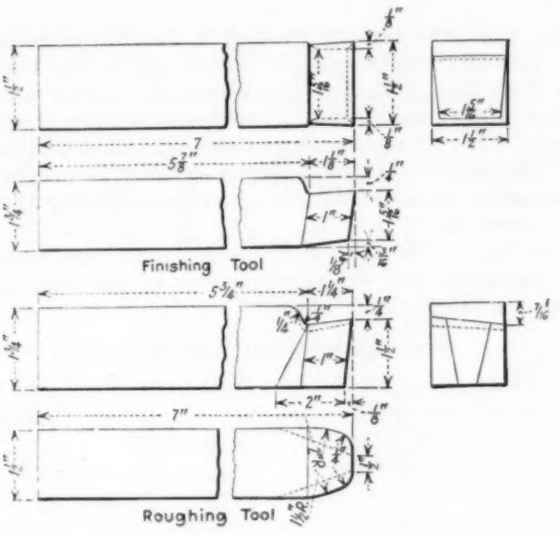


FIG. 8. NEW YORK CENTRAL

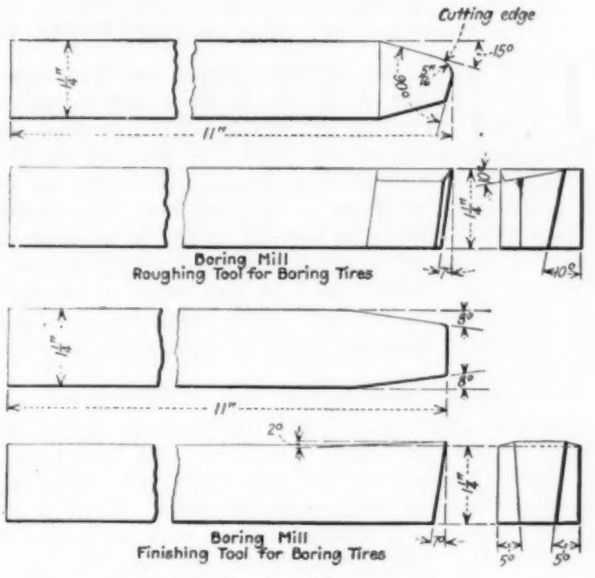


FIG. 9. PENNSYLVANIA

with liberally rounded corners and top rake of 12 deg.

No. 4. These tools have high-speed tips welded to the body and in the case of the finishing tool, the cutting edge is 6 in. wide. Details are shown in Fig. 4. They have a side rake of 8 deg.

No. 5. Tools ground to shape on Sellers tool grinder.

No. 6. The blue chip steel used is heated white hot, dipped in oil and then cooled in an airblast. The roughing cut is from ¼ to ½ in. deep, the finishing cut from ⅛ to 1/16 in. deep.

No. 8. The triple-mushet steel used is heated slowly to 1,500 deg. F., then rapidly to 2,200 deg. F. and cooled in airblast. A round-nosed tool is used for roughing. The flat-nosed tool shown in Fig. 5 is used for finishing the bore of the tire.

No. 9. As can be seen from Fig. 6, the boring tool has a side rake on top of the cutting edge. A double-headed boring mill is used, both roughing and finishing cuts being taken at the same time. The same type of tool is used for both cuts but the nose of the finishing tool is flattened a little, as shown.

No. 10. Details of the roughing and finishing tools for boring tires are shown in Fig. 7, the rake and clearance being given in inches instead of degrees as in the table.

No. 11. The roughing tool has a round nose, while the finishing tool has a straight cutting face. The finishing tool is 1 x 2 in. After the roughing cut is started, the finishing tool is set to size and follows the roughing cut through the tire, using the same feed.

No. 12. The Midvale steel used is preheated to 1,800 deg. F., then reheated to 2,300 deg. F., quenched in oil and drawn to 1,100 deg. F. The roughing tool has a round nose and the finishing tool is square. The tools are ground on a Sellers tool grinder.

TABLE I. CONDENSED TIRE BORING TOOL DATA FROM SEVENTEEN RAILROADS

Name of Railroad and Shop	Size of Tool Body, Inches	Top Rake of Tool, Degrees	Clearance at Point, Degrees	Cutting Speed Feet per Min. Roughing	Cutting Speed Feet per Min. Finishing	Feed per Revolution Roughing	Feed per Revolution Finishing
1. Atchison, Topeka & Santa Fe, Topeka, Kans.	See sizes on drawing	12	15	18	18	¼	¼
2. Chicago & Alton, Bloomington, Ill.	1¼x1¼	8	6	25	25	¼	¼
3. Chicago & Northwestern, Chicago, Ill.	1½x1½	12	10	15	15	¼	¼
4. Canadian Pacific, Montreal, Can.	1 x1¼	6	6	14	12	¼	¼
5. Chicago, Rock Island & Pacific, Silvis, Ill.	1¼x1¼	6	7	16	16	1/16	⅛
6. Denver & Rio Grande, Burnham, Colo.	1¼x1¼	8	6	16	20½	1/16	1/16
7. Grand Trunk, Battle Creek, Mich.	1¼x1¼	8	5	26	26	1/16	1/16
8. Grand Trunk, Montreal, Can.	1¼x1¼	18	5	23	23	1/16	1/16
9. Hocking Valley, Columbus, Ohio.	1¼x1¼	8–10	7	40	40	⅛	⅛
10. Lehigh Valley, Bethlehem.	1½x2	7	8	12–20	12–20	¼	¼
11. Norfolk & Western, Roanoke, Va.	1x1	4	6	18	18	¼	¼
12. New York, New Maven & Hartford, Readville, Mass.	1x2	5	7	55	50	¼	¼
13. New York Central, Depew, N. Y.	1¼x1¼	4	4½	24	24	¼	¼
14. New York, Ontario & Western, Middletown, N. Y.	1x1	15	6	28	28	1/16	1/16
15. Pennsylvania, Olean, N.Y.	1¼x1¼	2	7	19½	19½	1/16	1/16
16. Philadelphia & Reading, Reading, Penn.	1½x3	6	4	30	30	⅛	⅛
17. Wabash, Decatur, Ill.	1¼x1¼	2	7	30	30	⅛	⅛

No. 13. Details of the tire-boring tools are shown in Fig. 8, the roughing tool being rounded on the nose and also having both top and side rake. The finishing tool is square.

No. 14. A diamond-point tool is used for rough boring and a broader surface for finishing. Both the roughing and finishing cuts are taken at the same time on a double-head boring mill. Tools are ground on a Gisholt tool grinder.

No. 15. Round-nose tool for roughing—flat-nose for finishing. Both are shown in Fig. 9. Both are used at once on double-headed boring mill.

No. 16. There is a side rake on the roughing tool and a slight top rake on the finishing tool.

Starting Right on the Gage Question

Standard Nomenclature of Gages and Gaging Operations—Types of Gages Defined—Temperature for Comparison of Gages—Notes on the Uses of Gages

SPECIAL CORRESPONDENCE

THE Committee on Plain Gages for Engineering Work of the A. S. M. E. is trying to make a sound beginning by having all terms used thoroughly understood at the start. It believes, that the terms and definitions used should, as nearly as possible, conform to those in common use. The coining of new terms should be avoided as far as possible, and where a choice of terms is available weight should be given the term being the most significant or subject to the least misconstruction. With these ideas in mind, the following fundamentals and definitions have been adopted:

Direction of Tolerance on Gages.—The extreme sizes for all plain limit gages shall never exceed the extreme limits of the part being produced. All variations in the gages, whatever their cause or purpose, shall bring the gages within these extreme limits. Thus a gage which represents a minimum limit may be larger, but never smaller than the minimum size specified for the part being produced; while the gage which represents a maximum limit may be smaller, but never larger, than the maximum size specified for the part being produced.

Temperature at Which Gages Shall Be Standard.—This committee recommends the use of 68 deg. F.

The final result sought by gaging is interchangeable manufacture in some degree. This means that the parts of a mechanism can be assembled without *fitting* one part to another and when assembled the mechanism will function properly.

Applied to manufactured material, the result sought is sufficient uniformity in size and contour to adapt the material to the requirements of the industries without further fitting. The fundamental principle involved in interchangeable manufacture requires that "A system of standardization and classification of fits must establish a clearly defined line at which interference between mating parts begins." Hence: (a) The standard or basic size, as physically represented by a correct standard master gage, represents the line at which this interference begins on mating parts. (b) It is the minimum size of the external members of all mating parts of standardized practice, regardless of the kind of fit. (c) It is the maximum size of internal members of all mating parts where interference begins or that fit metal to metal; the conditions of (b) and (c) are represented by a mating pair of correctly fitting standard gages. (d) The limits of the component as physically represented by the limit master gages must never be exceeded as a result, either of error or wear of the gages. (e) "Go gages" or the equivalent verification of all the factors involved in the fit are necessary to prevent interference of mating parts. In the case of force fits, "go gages" are necessary to determine the maximum amount of interference between mating parts. (f) "No-go gages" or the equivalent verification of the determining factor are necessary to prevent the maximum looseness of mating parts exceeding the limits specified.

In the case of force fits, "no-go gages" are necessary to determine the minimum amount of interference between mating parts.

Definitions With Illustrations

(1) *Gaging*—A process of *measuring* manufactured material to assure the specified uniformity of size and contour required by the industries.

(2) *Gage*—A device for verifying one or more of the specified *limits* of manufactured material; (a) *Ring Gage*—One with inside measuring surfaces circular in form. The measuring surfaces may be cylindrical or conical. The exterior shape or form of the gage is immaterial. (b) *Plug Gage*—One with outside measuring surfaces arranged to verify the specified uniformity of holes. A plug gage may be straight or tapered and of any cross-sectional shape. (c) *Receiving Gage*—One with inside measuring surfaces arranged to verify the specified uniformity of size and contour of any piece of manufactured material. (d) *Indicating Gage*—One that exhibits visually the variations in the uniformity of dimensions or contour, the amount of the variation being measured by a graduated scale or by marks, such as dial, lever, flush pin, plunger gages, etc. (e) *Snap Gage*—A fixed caliper with inside measuring surfaces for measuring diameters, lengths, thicknesses, etc. (f) *Caliper Gage*—One which for internal members is similar to a snap gage, and for external members is similar to a plug gage.

(3) *Standard*—A fixed physical value defined by the Government, such as the yard and meter.

(4) *Standard Sizes*—Are a series of subdivisions of the yard and meter having correct values. (Note: The industries by common consent have chosen several different series important for interchangeable manufacture and when they have the correct value they are commonly called standard sizes. Such as: ½-in., ⅝-in., ¾-in., ⅞-in., etc.)

(5) *Nominal Size*—A name given to the subdivision of the unit of length having no specified limits of accuracy, but indicating close approximation to standard size.

(6) *Basic Size*—The exact theoretical value from which all variations are made.

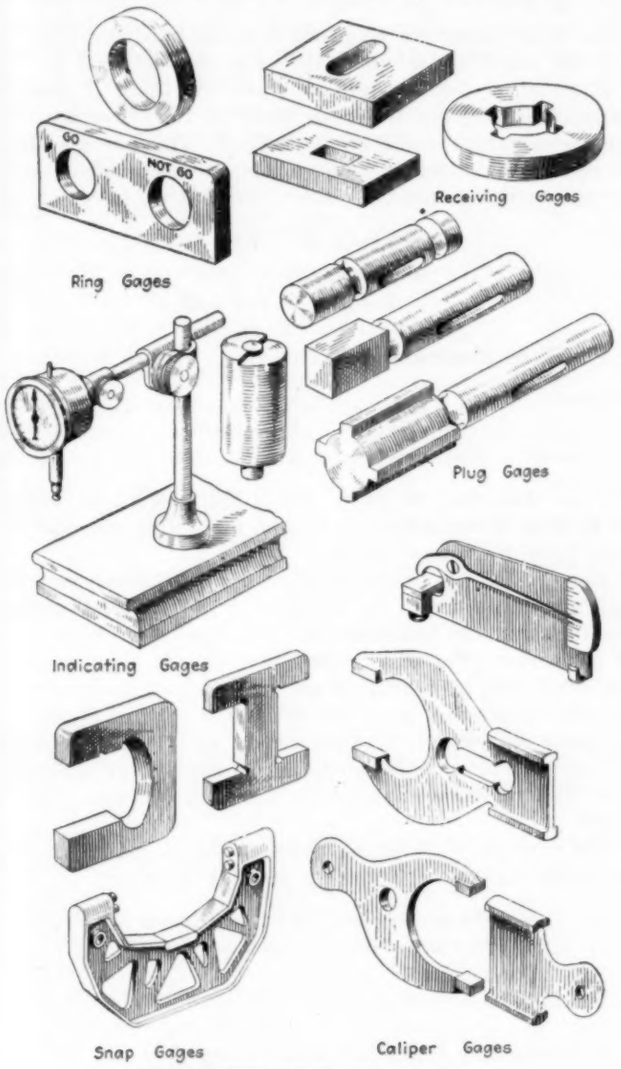
(7) *Allowance*—A difference in dimensions, the limits of which are prescribed. It is to provide for different kinds or classes of fits. It represents maximum tightness or minimum looseness.

(8) *Tolerance*—A definite difference in the dimensions prescribed in order to permit variations in manufacture. It is equal to the difference between the maximum and minimum sizes.

(9) *Neutral Zone*—A space between the mating parts which is not to be encroached upon.

(10) *Limits*—The extreme dimensions which are prescribed to provide for variations in fit and workmanship.

(11) *Master Gage*—One whose gaging dimensions represent as exactly as possible any physical dimension



DIFFERENT TYPES OF GAGES

or the component. It is the gage with which all other gages and all dimensions of manufactured material are finally checked or compared, either direct check or comparison: (a) *Reference Gage*—a commonly used name for master gage. (b) *Check*—another commonly used name for master gage. (c) *Standard Master Gage*—any master gage whose gaging dimensions have the standard or basic value of an established nominal size. The legal authenticity of a standard master gage should be established by having its deviations ascertained by the Bureau of Standards at Washington. (d) *Limit Master Gages*—Gages which represent as nearly as possible the exact limiting physical dimensions of the manufactured material as established by the specified tolerances.

(12) *Inspection Gages*—Gages for the use of the manufacturer or purchaser in accepting the product. They must not pass any product which the master gages will reject.

(13) *Working Gages*—Gages used by the manufacturer to check the work as it is produced. They should not pass any product which the inspection gages will reject.

How the Shop Manager Can Use an Appraisal—Discussion

BY L. L. THWING

I think that Mr. Farrell, on page 929, Vol. 54, is a trifle unfair when he cites as a typical appraisal one in which all materials were not arranged by buildings and by floors. This at least is a nearly universal practice with companies that have had any experience in such matters. It may be admitted that an undue amount of space is used in the enumeration of pipe and fittings, and the fundamental reason why this is done I do not know. I do know however that as soon as you send out various and sundry men to "estimate" piping, that this process becomes more and more sketchy, until the only practical recourse is to have it all taken. One other reason for these long lists is that they actually do impress the treasurer or other office men as being an evidence of extreme care. They ought not to, but they do.

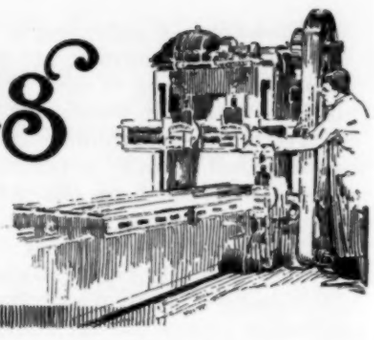
I have never yet seen a superintendent or shop manager who took an active interest in appraisals. They are usually annoyed by being asked so many questions while an appraisal is in progress. The demand for appraisals usually originates in the treasurer's office and is usually made for insurance or taxation purposes. For such purposes departmentalization is not needed and is not asked for, consequently it is not furnished. A separation of piping into separate list for manufacturing, power, heating, etc., is also made when requested, but to make an appraisal which will be adaptable to all possible uses, would indeed be an unjustifiable expense. A general purpose appraisal should have four columns of values: (1) Original cost remaining; (2) original cost depreciated, or present value; (3) replacement cost, new; (4) replacement cost, depreciated. Nearly any figures involving investment, values, or insurable values can be taken from these columns.

One other thing that I object to is the arbitrary assigning of rates of depreciation, and particularly such assumptions of accuracy as 6⅔ per cent. Depreciation is a fact and not a theory to be worked out by empirical rules.

I do think that if you can get the appraisal out of the safe in the treasurer's office into the shop manager's office and particularly into the cost department, that a much better use will be made of it, and the next time an appraisal is to be made suggestions will be forthcoming as to what additional information or classification can be used to advantage. Neither appraisal companies or industrial engineers are perfect. The first give you what you ask for, and the second what they think you ought to have.

Metal Cutting Tools.

By A. L. DeLeeuw



XIV. The Use of Liquids When Cutting Metal—For Purposes of Lubrication—For Carrying Off Heat and Washing Out Chips

LIQUIDS used when cutting metal are often called lubricants. This name may or may not be correct, because liquids are used for three distinct purposes: For lubrication; for cooling; for washing out chips. We will first treat of liquids used as lubricants.

It is a well-known fact that the use of liquid when cutting metal has a very marked effect on the finish produced. Besides, it will affect the amount of power required under certain conditions and it may affect the size of the finished piece. At a first glance it would seem strange that the use of a liquid can have any effect whatsoever on the finish produced because the liquid cannot affect the surface until after the surface has been produced by the tool. Efforts have been made to explain the action of a lubricant by considering the fact that the splitting off of a chip probably occurs a little distance ahead of the tool point and that therefore the lubricant might penetrate between the chip and the work some distance ahead of the tool. But this cannot affect the way in which the chip is being separated from the body of the metal. It will therefore be necessary to look somewhat closer into the manner in which the tool effects the formation of the chip in order to explain some of the well-known effects of a lubricant on the cutting action of a tool.

In Chapter I reference was made to the probable way in which the chip is being separated from the work. All observations made so far point in that direction and though the statements made there should not be considered as statements of fact, but rather as the writer's way of visualising what happens when a tool acts on a piece of work, yet these considerations lead to so much clearer an understanding of the cutting action of tools that it may be well to go somewhat further in the same direction; constantly remembering, however, that we are dealing with a hypothesis which may have to be modified when careful observations on this subject have been made.

In Fig. 221 a tool is about to split off a chip. The tool is shown as having a contained angle of 90 deg., a condition which does not prevail in practice. We will further consider the effect of the tool on the chip only, neglecting everything except the fact that there is resistance against splitting off; in other words, we will not consider compression or friction between the chip and the work or friction between chip and tool or various other items. The thickness of the metal to be removed—in other words the depth of cut—AB will be called t; the width of work b; the unit resistance against shear S the pressure required for this splitting off P; and the angle along which the chip will split off β.

If no other forces were at work the force P would be counteracted by the resistance in the direction of the arrow, which would be Sbt cosec β. This force would be equal, but opposite in direction, to a component of force P, which would be $P \cos \beta$; so that we have:

$$P \cos \beta = Sbt \operatorname{cosec} \beta$$

$$P = \frac{Sbt \operatorname{cosec} \beta}{\cos \beta} = \frac{Sbt}{\cos \beta \sin \beta}$$

P will be a minimum when $\dfrac{Sbt}{\sin \beta \cos \beta}$ is a minimum or when

$$\sin \beta \cos \beta = \text{maximum}$$

and this is so when $\beta = 45°$

We see then that all chips would split off at an angle of 45 deg. if no other conditions had to be considered than those mentioned above.

However, if we introduce some other element we will find that this result is modified. In the first place, the fact that the tool bears on the chip in the direction of the arrow (Fig. 221), causes the chip to bear against the work with a pressure equal to $P \sin \beta$. This pressure has the same effect as if the resistance against splitting off were increased; in other words, as if the molecular attraction between the particles of metal were greater. The total resistance against splitting off becomes, therefore:

Sbt cosec $\beta + P \sin \beta$, which is the resistance to be overcome by the pressure P, so that we have:

$$Sbt \operatorname{cosec} \beta + P \sin \beta = P \cos \beta$$
$$Sbt \operatorname{cosec} \beta = P (\cos \beta - \sin \beta)$$

$$P = \frac{Sbt \operatorname{cosec} \beta}{\cos \beta - \sin \beta}$$

In order that P shall be a minimum

$$\frac{Sbt \operatorname{cosec} \beta}{\cos \beta - \sin \beta} \text{ must be a minimum}$$

Dropping the constant Sbt,

$$\frac{\operatorname{cosec} \beta}{\cos \beta - \sin \beta} = \text{min.}$$

$$\frac{\cos \beta - \sin \beta}{\operatorname{cosec} \beta} = \text{max.}$$

$$(\cos \beta - \sin \beta) \sin \beta = \text{max.}$$

Differentiating we find:

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$$\cos\beta\, d\sin\beta + \sin\beta\, d\cos\beta - 2\sin\beta\, d\sin\beta = 0$$
$$\cos^2\beta - \sin^2\beta - 2\sin\beta\cos\beta = 0$$

As $\cos^2\beta - \sin^2\beta = \cos 2\beta$ and as $2\sin\beta\cos\beta = \sin 2\beta$ we have

$$\cos 2\beta - \sin 2\beta = 0$$
$$\cos 2\beta = \sin 2\beta$$
$$2\beta = 45°$$
$$\beta = 22° 30'$$

This shows that in reality chips do not split off at an angle of 45 deg. and also how greatly the introduction of another factor affects the final result.

When the tool penetrates into the work and causes a chip to split off, it moves the chip against the remaining parts of the metal and also against the tool. We have seen how the resistance of shear affects the angle of splitting, also how the pressure of the chip against the work affects that angle, and we will now investigate what effects the friction of the chip against the tool has on the final result.

In Fig. 222 a planer tool is shown removing a chip. The chip is shown as bearing against the tool some distance from the point where it is being separated from the work. Under the conditions represented in the sketch the sections of the chip offer so much resistance against sliding one over the other that the tool is not able to reach the solid part of the metal, as the pressure between tool and chip is great enough to cause a new section to split off. The distance between the point where the splitting off takes place and the tool point is a variable quantity and depends on a great many elements. It was for the purpose of showing how the final result is largely affected by a variation in one of the elements that the two hypothetical cases were taken at the beginning of this chapter.

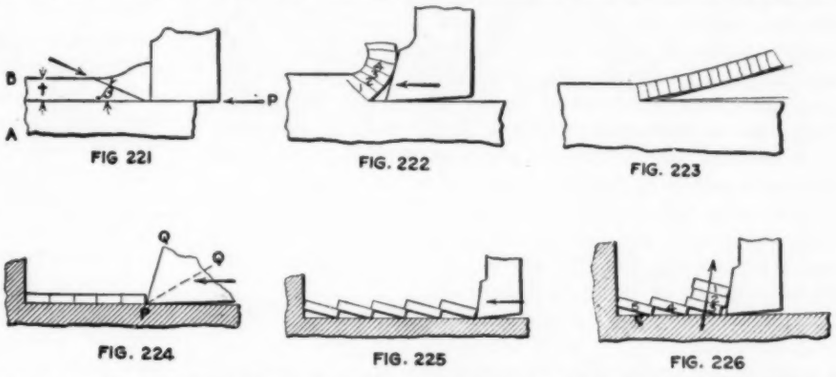


FIG 221 FIG. 222 FIG. 223

FIG. 224 FIG. 225 FIG. 226

FIG. 221. THEORETICAL TOOL ABOUT TO BREAK OFF CHIP. FIG. 222. ACTUAL PLANER TOOL TAKING CHIP. FIG. 223. THEORETICAL TOOL WITH EXTREME RAKE. FIG. 224. WEDGE ACTING ON ABUTTING BRICKS. FIG. 225. BRICKS ARRANGED LIKE CHIP SECTIONS. FIG. 226. POSITION OF BRICKS AFTER TOOL ADVANCES

When the tool has no rake the chip tends to split up at an angle of 22½ deg. with the work. Consequently the length of the line along which a section of the chip splits off is several times the thickness of the metal to be removed. As a result the pressure between tool and chip is very great. If, on the other hand, we should have a tool with a very large amount of rake, such as represented in Fig. 223, the plane of cleavage will be almost at right-angles to the work and the length of the line along which the chip splits off is but very little more than the thickness of the metal to be removed. Under the condition shown in Fig. 223 which, of course, does not occur in practice, it is not even necessary for the chip to be completely split off. It merely needs to be displaced slightly in relation to the next section of metal in order to allow the tool to penetrate further. We have here very much the same condition as when an impression is made in a piece of sheet metal by a punch and dies, but without completely punching through. Consequently a chip sliding over the tool has almost the same strength as the original metal. The pressure required for splitting off is very much less than under the conditions shown in Fig. 222. After a section has moved far enough to permit the tool to penetrate somewhat farther, the entire chip can bend. It is not necessary that this chip should be further deformed. Here, then, we have the two extreme conditions: in one case the line of cleavage is long, the pressure required for splitting off one section is great, and the sections slide one over the other a long distance in order to permit the tool to penetrate further. In the second case, the line of cleavage is short, the pressure required for splitting off one section is small, and the sections do not need to slide one over the other after the first initial shear has taken place and has permitted the tool point to penetrate farther.

There is another element which modifies these conditions still farther and makes the difference between the two extremes still more pronounced and that is that the resistance caused by the friction against the work is almost, though not quite, at right-angles to the face of the tool. It may be expected that the coefficient of friction between a rough chip and the surface of the tool must be very great. Under the conditions shown in the sketch the pressure between tool and chip is practically the same as the pressure required for the shearing off of a chip and this pressure is almost at right-angles to the tool. To understand better what will happen under such conditions, let us suppose that a number of bricks are laid on the ground and abutting against a wall, Fig. 224. We take some implement *A* and push it in the direction of the arrow with sufficient force to overcome any resistance there may be. If the front of the implement is the line *PQ*, almost at right-angles to the direction of motion, it will not be possible for the implement to get under the brick and lift it up, as the brick will refuse to slide over the face of the implement. As a result, the bricks will have to be crushed in order to allow the implement to move forward. If, on the other hand, the face of the implement were in the direction of the line *PQ*, we would need only sufficient force to lift the weights of the bricks and overcome the resistance of friction between the bricks and the implement. This friction depends on the surface of both bricks and implement and on the weight of the bricks.

Referring again to Fig. 222, the individual sections of the chips are the bricks. Their weight is the resistance they offer against shear. The chief difference is that while in Fig. 224 the bricks are laid against each other so that each one forms the abutment for the previous brick, the sections of a chip are arranged somewhat like shown in Fig. 225, except that whereas in

Fig. 225 the bricks would be free to slide over each other (except for the friction between them), in the case of a chip the resistance between the various sections is very great and is, in fact, the resistance against shear. As the implement advances in Fig. 225, we get the condition shown in Fig. 226, which shows that the bricks must have moved in the direction of the arrow sliding past the implement. The pressure against the implement is then composed of two elements: the pressure required to push brick 3 over 4, and to slide bricks 1, 2 and 3 along the implement. This shows that the total pressure is much more than that required for the separation of the chip only.

In taking a heavy cut the pressure against the tool is so great that the front of the tool is rapidly worn away. It is not possible to say what the coefficient of friction between the chip and tool may be, but it is not likely that it would be less than 0.40 or 0.50; so that we may expect that the work done in overcoming this friction is somewhere in the neighborhood of half the amount required for splitting off of the sections. Besides, when the front of the tool is nearly at right-angles to the direction of its movement, it may not be possible at all to make the chips slide. In that case the chip must be crushed so as to get out of the way of the tool. All of this means that a large amount of power is consumed for no useful purpose and that the tool will wear out very rapidly. Anything that can be done to decrease the friction between chip and tool must then materially reduce the amount of power required and will prolong the life of the tool. And this is one of the objects of applying a lubricant.

There are actually three ways in which we can reduce this friction. In the first place we can give the tool a very sharp angle, thus reducing the presure required for splitting off a chip; by doing this we increase the length of the path of the chip over the tool. If we have reduced the pressure to half its original amount, but we make it slide over the tool double the distance, we have not saved any power required for overcoming the friction, but we have reduced the wear on the tool. Furthermore, we now have a tool with such a delicate cross-section that it is apt to break, while at the same time the cross-section is no longer sufficient to carry off the heat, so that the tool is liable to failure on account of softening of the steel. The second method would be to give the tool a polished surface, thus reducing the coefficient of friction. This simple method of reducing the friction is very seldom employed, strange to say. The writer's experience has been that this is a most efficient way of prolonging the life of the tool and reducing the power required in a great many instances. The third way is to apply a lubricant, which has the same effect as the polishing of the front of the tool, but which has the advantage of being independent of the length of time that the tool has been in action. It stands to reason that, if the front of the tool is polished, it must gradually lose its polish, so that by and by the tool, will be in the same condition again as if it had never been polished; whereas if we apply a lubricant its beneficial effects will be the same during all of the time we use the tool. Of course, doing both is best of all.

If the tool were placed in relation to the work as it is shown in Fig. 227, the lubricant, coming in in the direction of the arrow, could do but little if any good, because that portion of the chip which strikes the tool under the heaviest pressure completely shuts off any possibility of the lubricant reaching a section of the metal which is not yet bearing against the tool. This condition, however, does not exist in practice. Fig. 222 shows more nearly what actually occurs. The front of the tool does not bear against the section which is being split off, but against some section which has already been split off, and there is an opening left of approximately triangular shape between the front of the tool, the finished part of the work and the chip. This opening is shown in exaggerated form in Fig. 222. If the lubricant can enter this opening it will lubricate the front of the tool before the chip bears up against it. In Fig. 222 section 4 is suposed to bear up against the tool; section 3 is in close proximity to the tool but not yet against it; section 2 has just been split off, and section 1 is beginning to split off. When the tool advances in the direction of the arrow, section 3 will become the one which bears up against the tool. It will not bear directly against the metal but against a film of oil. The adhesion between the different sections is great enough to transmit the pressure from the tool to section 1.

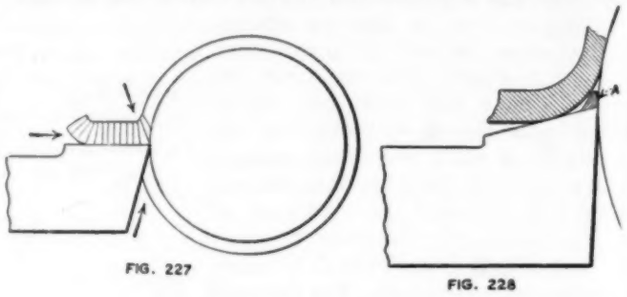


FIG. 227 FIG. 228

FIG. 227. A CONDITION UNDER WHICH LUBRICATION WOULD BE USELESS. FIG. 228. ACCRETION OF METAL PARTICLES ON TOOL POINT

The question now is what conditions must be fulfilled to enable the lubricant to penetrate into the triangular space between tool and work. The size of the triangular opening is very small. The thickness of the individual section is also very small, so that a great number of these sections are split off per minute, and this number becomes greater with increased cutting speed. The tool must advance a certain distance before the next section will begin to split off. In other words, some of the lubricant is squeezed out of the triangular opening before a new section is split off. Putting it still another way, the size of the triangular opening contracts and expands once for every new section split off. During the time that this triangular opening expands the lubricant must flow in, in order to be of some use for the purpose of reducing friction. The direction in which this lubricant enters the triangular opening is at right-angles to the direction of the cut, or we might say at right-angles to the plane of the illustration.

If we take a lathe cut, one side of the chip still adheres to the work so that the lubricant can flow in to a depth equal to the amount of the feed per revolution. This may be anything from 0.01 to ¼ in. or even more, and as the cross-section of the triangular space is, of course, exceedingly small, the lubricant must penetrate at a very high rate of speed in order to cover every part of the tool. The fact that we may have a large stream of lubricant pouring over the tool does not help any. We must depend on the adhesion between the lubricant and the material to be cut

for its penetration. We may say, then, in a general way that we should use a lubricant which will spread very quickly over the metal. Such lubricants would be thin oils, and if we did not have to consider any other facts we could say that thin oils must be used for lubrication. However, a thin oil would not help as a lubricant under the extremely heavy pressure that exists between the chip and the tool, so that if we want to have a real lubricant we should use a very heavy oil. There are, then, two opposing requirements. The speed with which the oil must penetrate requires a light oil, and the pressure which it must resist requires a heavy oil.

We will now see to what extent we can harmonize these two opposing conditions.

Everybody who has ever taken a heavy cut on a lathe must have noticed how sometimes chips will stick to the surface of the tool. A little closer observation will show that this sticking of the chip to the tool is not always the same thing. Sometimes one finds quite a considerable chip adhering to the tool surface, but only lightly, so that the touch of a finger will remove it. Sometimes one will find one or two sections of the chip stuck to the tool and it takes considerable pressure—the blow of a wrench or the push of a screwdriver—to remove it. At still other times one will find that a little hill has been built up close to the cutting edge and, looking at it with a magnifiying glass, this hill may appear as a densely compact little mass of very fine particles of metal and sometimes as if these fine particles had been welded together and onto the tool. This last condition is the most dangerous.

When such a little heap of fine particles has formed and has been welded to the tool point, one may expect failure of the tool within a very short time—but not always. Fig. 228 shows a tool with such a little heap of metal welded on and also shows a chip in state of formation. The mass of metal built up at the tool point is marked *A*. So long as this little mass of metal is within the triangular space between work, chip and tool there is a possiblity that the tool may go on functioning. But when this litle heap of metal extends further, so that the chip must ride over it, then the friction created at that point will be so severe that the particles of metal are welded together and that porition of the tool over which the chip must slide becomes hot and soft enough to break down under pressure of the chip.

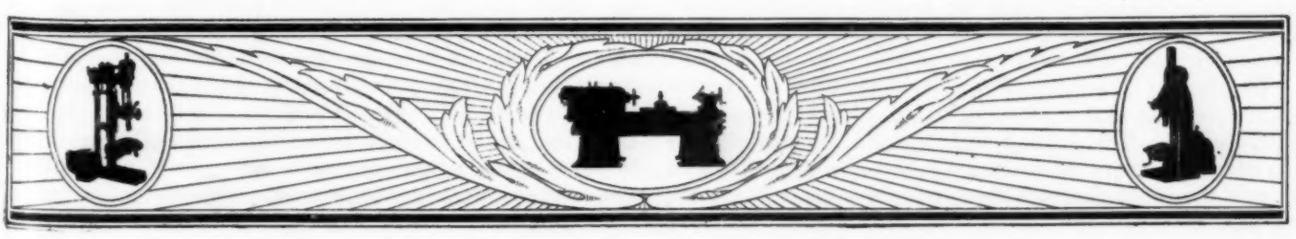
This manner of failure is quite common when taking heavy cuts, and especially when no lubricant is used. If a lubricant is used and this condition prevails, it is evidence that the lubricant did not reach the tool point in the proper manner. We have observed that this little heap of metal does no great harm as long as it is not welded together by the friction of the tool, and on the other hand we might have noticed that there is very little danger of a solid hill building up so long as the tool can be kept cold. The thing to do, then, is to make sure that the lubricant gets into the triangular space and that it is of such a nature that it will carry off the heat, thus preventing the particles of metal from welding together.

Mineral oils do not take up heat as readily as some animal or vegetable oils, such as lard oil, fish oil, or olive oil. On the other hand, these vegetable or animal oils do not have the lubricating qualities of the heavier mineral oils. Lard oil, for instance, will carry off heat much better than a heavy mineral oil, and it has about the same lubricating qualities as a light mineral oil. There is no liquid which would take up heat as readily and to as great an amount as water, but its lubricating qualities are very poor. Some heavy mineral oil would be an excellent lubricant under great pressure, but it would be almost useless for the purpose of cooling work and tools. Lard oil, or some other oil with the same qualities, would not be as good a coolant as water, but would have much better lubricating qualities; nor would it be as good a lubricant as heavy mineral oil, but it would be a much better coolant. So that, altogether, lard oil is a very good compromise between the two extreme conditions we have to meet. When we use lard oil for light cuts, we will have pretty nearly ideal conditions because, though its lubricating qualities are not very high, they are as high as may be necessary for the cut we are taking.

Light and Heavy Lubricants

The nature of the lubricant to be used is often based on the nature of the machine. It is rather natural to think that a machine which requires 10 hp. should need a heavier lubricant for the cut than some other machine which requires only 5 hp. This, however, is not correct. We should not look at the amount of power the machine requires, but at the size and particularly at the width of the chip. For instance, if we should take a cut $\frac{1}{4}$ in. deep and with $\frac{1}{16}$ in. feed, we will obtain a thick and strong chip which will bear heavily on the tool, and such a cut will require a heavy lubricant. The amount of metal we have removed has a cross-section of $\frac{1}{64}$ of a square inch. If we should take a forming cut on a large screw machine, a cut say 7 in. long and with about 0.002 in. feed, we would remove the same amount of metal per revolution; the chip would have the same area of cross-section, but would be of an entirely different shape. At no point would there be a heavy pressure between chip and tool, and for that reason a heavy lubricant is not required. Furthermore, a heavy lubricant under those conditions would be detrimental for, as this lubricant must flow into the exceedingly long, triangular groove left between chip, work and tool, it must have great fluidity in order to reach all the points of the tool, so that a heavy lubricant would not serve at all. This will illustrate how necessary it is to study the peculiarities of the cut before determining what lubricant will give the best results.

(Continued in next week's issue)



The Human Machine in Industry

Care of the Human Machine as Necessary as Care of Machines of Metal—Length of the Working Day—Periods of Rest—Fuel

By WALTER J. MATHERLY

THE science of machinery reigns supreme in industrial organization. In the selection and testing of all mechanical devices, exact scientific standards are followed. Nothing is left to chance. Every precaution is taken to get the very best. Whatever machines are chosen are chosen with regard to their fitness for particular purposes. The strictest attention is given to the raw materials out of which they are made; to the speed at which they are to be run; to the avoidance of unnecessary friction; to keeping them well oiled and cleaned, and to the efficiency with which they are to perform their functions. The whole purpose of technological science is to construct mechanisms which will produce a maximum output at a minimum of expense, in money, mechanical injury, and deterioration.

Machines of iron and steel, however, are not the only machines which are essential to industry. They are not the only mechanisms which are subject to scientific analysis, and which are worthy of the closest scrutiny with regard to the speed at which they should be run, the care which they should receive, and the output which they should produce. To them must be added human machines. By human machines is meant the industrial workers themselves. As physical entities such workers are complexes of body and mind. They are human organisms, and may be regarded with reference to standards of industrial efficiency as human mechanisms. Such a conception in no wise involves any disparagement of the workers, nor is it opposed in any manner to the principles of physiology.

Science as Related to the Human Machine

Naturally, the science of human machines is not as highly developed as the science of non-living machinery. Not as much attention has been paid to it. The reason for this is that emphasis in the past has been placed on mechanical factors and processes. The technological aspects of industrial organization have been given ascendancy. The aim has been the standardization of metal machines rather than human machines. The goal has been the efficiency of inorganic matter rather than the efficiency of living matter.

There has been a change of front along this line, however. Since human beings play such a large part in industry, the chief point of emphasis today is the human factor. It is beginning to be recognized that the human as well as the non-human machine must be standardized. The big problems for solution are not so much problems of technics as problems of personnel. The greatest industrial need is not for the science of mechanics, but rather for the science of humanics. The great objective is or ought to be the organization of industry on a physiological and human basis rather than on a mechanical and non-human basis.

The human machine which is beginning to receive such scientific notice is superior to all other machines in industry. The human body is the mechanism par excellence. There is no engine like the engine which pumps the blood through the human system. There are no pipe lines for the transportation of liquids that are comparable to the arteries and veins. There are no grab buckets and steam shovels that are as deft and accurate as human fingers. There are no machines in manufacturing establishments that can automatically lubricate themselves or that can replace themselves without depreciation funds as can the human machine. Indeed, the human body transcends all other machines in the specialization of functions and the co-ordination of parts, and stands out as the mechanism of all mechanisms.

Mental and Physical Energy

The mental and physical energy which human machines generate is indispensable to the economic structure. To fight in the business arena, or to work in the plants of production, physical and mental prowess is necessary. The best workers, whether executives or employees, are men of strong physique. Strength has characterized almost every master workman. To meet the demands of present-day industrial activity, men must be veritable steam engines. They must have strong bodies and be able to endure all industrial wear and tear. In a word, strong human machines are absolutely essential to the organization of all industrial enterprises.

While human machines must have strength, their strength is somewhat different from that of non-living machinery. Unlike machines of metal, industrial workers can not do the same amount of work each hour of the day or even each day of the week. The longer the hours they toil the less will they produce. The curve of output, as investigation has frequently shown, decreases with the increase of fatigue. Production is greatest in the early hours of the morning when the workers are freshest, while it is smallest in the late hours of the afternoon or in the hours worked overtime, when the worker's supply of energy is exhausted and fatigue has stored the body with poison.

The same is true more or less for the weekly curve of output. While production is relatively low on Monday, it rises to the highest point by mid-week and then tends to drop to the lowest level at the end of the week. Low production on Monday is known as the "Monday effect." The cause for it has been ascribed to dissipation at week-ends. A better explanation seems to be "the lack of neuro-muscular co-ordination" due to Sunday rest. Whatever the reason for the relatively low output at the very beginning of the week, production follows about the same course as daily output for the rest of the week, declining generally, though not always, at the end of the week with the increase in fatigue.

Fatigue of Night Work

The effect of night work on output is still more noticeable. Night workers, as was brought out by experiments in munition plants during the war, are never as productive as day workers. While the level of production rises in the early hours of the night, it drops down to almost nothing during the last two hours before day, the laborers often going to sleep on the job. So far as the quantity of products turned out is concerned, night

workers might as well be sent home for rest and sleep during the last two hours as to be kept at their posts of duty without the capacity to perform their tasks with even half-way efficiency.

Still another evidence of the effect of fatigue on the workers is its relation to industrial accidents. With the increase of fatigue there is an increase in accidents. This signifies that the longer human machines operate the less accurate they become in the performance of their functions. Unlike machinery constructed from dead matter, they can not do their work with precision indefinitely. It must be clearly recognized that there is a point in the utilization of human materials beyond which it is industrial folly to attempt to go.

All of this indicates "that fatigue is an enemy to high production." Since such are its effects, provision must be made for its removal as far as possible or at least for reducing it to a minimum. This suggests at once the length of the working day. How long should the working day be? What is the number of hours most conducive to highest daily efficiency? While there may be some exceptions, the evidence which is gradually accumulating seems to point to eight hours as the best condition for the highest productivity. In the light of industrial output, the scientific standard for running human machines may be found after all in the old adage of eight hours for work, eight hours for sleep and eight hours for play.

In further reducing industrial fatigue, rest periods during the day ought to be provided. Opportunities for moments of relaxation ought to be given. Wherever possible, suitable seats ought to be installed instead of having the laborers stand all day. Under no circumstances ought the human machine be worked overtime or be driven at a high rate of speed in absolute disregard of its capacity for productive effort.

Men Should Rest One Day in Seven

In most cases weekly labor ought to be confined to six days. One rest day in seven is just as necessary in industry as it is in religion. While daily fatigue may be lessened in a number of ways during working hours and more or less completely removed at night by sleep, weekly fatigue requires something more than this. It requires, in order for the workers to recuperate completely, a strict observance of Sunday rest. Anything less than this would be a short-sighted policy in the scientific management of industry.

Moreover, all night work probably ought to be prohibited. Men are diurnal, not nocturnal, animals. Night work on their part is abnormal. For centuries they have toiled in the day and restored their expended energies at night. To work at night is to go against the habit of generations. The only way by which as much can be produced at night as in day is to bring about a reorganization of the entire human mechanism. Instead of trying to go so far as to reconstruct human nature outright, it is probably better to confine man's industrial activities to daylight and eliminate night work altogether from the realm of production.

In addition to reducing fatigue to a minimum, there are other measures which must be taken into consideration in order to increase the efficiency of human machines. Foremost among such measures is the providing of proper fuel. Proper fuel to industrial workers means proper food. Those who toil at the lathe or forge can not perform their tasks successfully unless they are adequately and wholesomely fed. Attention must be directed to their diet. They must have access to a balanced ration. If they do not get it outside of the plant then employers must see that they get it within the plant by operating cafes and canteens at actual cost for their particular benefit. Without an adequate supply of proper fuel, human engines can not produce the energy which is needed in the operation of industrial enterprises.

Human machines must not only have the right kind of fuel but they must also be kept clean. No industrial mechanism can do its work acceptably unless it is kept free from dirt both within and without. The human machine is no exception. It is just as important to remove grease, rust and grime from it as it is to remove them from other machinery. To this end all manufacturing plants ought to provide adequate bathing and toilet facilities, maintain the strictest standards of sanitation, and improve the factory environment in every way possible. Indeed, not to take these precautions and provide clean surroundings for the laborers is to neglect the productive capacity of the whole industrial structure.

Waste Motion Should Be Eliminated

Furthermore, human machines must not be allowed to operate with waste motion. This imperative involves the problem of wasted energy. Motion studies have demonstrated that workmen make many idle and useless movements. Much activity of hands and legs is absolutely without profit. As illustrative of this, it has been shown by actual experimentation that the motions in laying a brick may be reduced from eighteen to one and three-fourths. Scientific experiments have proved also that just as great savings as this can be effected in other occupations. In the midst of such facts, it is an industrial crime of great magnitude to allow employees to waste their energy by excessive activities. If a maximum of human power is to be provided for the processes of production, all waste motions must be eliminated from the tasks of industrial workers.

Nor is this all. In order to keep human machines in good running order the science of industrial medicine must be encouraged. Plant physicians and nurses must be employed. Hospitals and first-aid stations must be added to factory equipment. Contagious diseases must be detected and kept from spreading among the working forces. Dental services must be made available. Physical examinations must be required not only of new employees but also of old employees in order to discover defections, and properly treat and remove them. In short, industrial medicine must do everything within its power to keep the whole labor force in perfect working order and efficiency.

Finally, in strengthening the productive power of human machines, the problem of labor turnover must be considered. The turnover of factory employees means a change in personnel. It indicates an annual replacement of so many human machines. It signifies an annual installment of so many new mechanisms. This, like the installment of all other new machinery, is costly. It is impossible to change the entire personnel of an industrial plant without a great loss of time and a big expense in hiring the new workers, initiating them into their tasks, and training them for high-grade service. To provide the greatest industrial efficiency in factory, mill and shop, the turnover of human machines must be reduced to the very lowest limits.

Manufacturing with Special Machines vs. Standard Equipment

III. Planing, Milling, Boring and Drilling Operations—Types of Machines and Fixtures Used—Special Planer with Uprights Set at an Angle

BY COL. G. F. JENKS* AND M. H. CHRISTOPHERSON†

OPERATION 12, consists of boring a semi-circular cut in the recess of the sleigh between the reservoirs and is illustrated in Fig. 15. Two Otis type-5 boring mills were used for this purpose

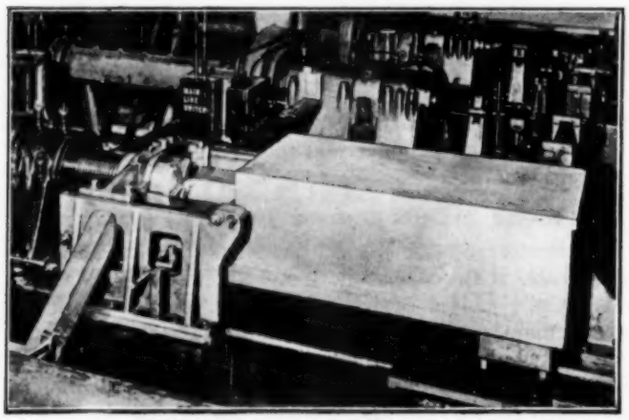


FIG. 15. BORING A HALF HOLE

by installing a crosshead directly behind the cutter head, thus forming a bearing and support for the boring bar by permitting the crosshead to move endwise with the bar on a sustantial slide bolted to the bed of the machine.

Revolutions of boring bar, 12 per minute. Peripheral speed of 11⅜-in. diameter cutters, 36 ft. per minute. Feed of cutter head, 5½ in. per hour. Average time setting sleighs and removing 990 cu.in. of metal in this operation was 6 hr. The time for this operation at the Arsenal was 7.51 hours.

The sleigh as originally designed had the recess cut out in rectangular outline instead of semi-circular as finally made, which made it necessary to mill the recess between the reservoirs on a vertical spindle milling machine requiring on an average, 45 hr. One sleigh while being milled in this manner was spoiled by the operator who, through inattention to his work, permitted the cutter to feed into one of the reservoir walls.

OPERATION 14

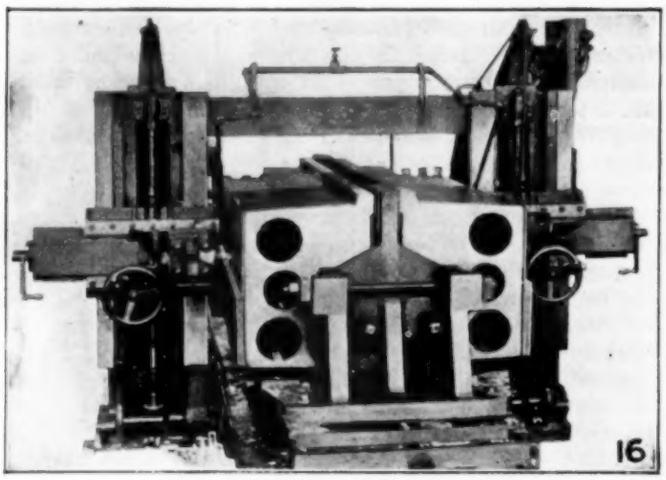
Counterboring the end of both reservoirs 2⅝ in. deep to form a seat for the reservoir caps and preparatory to machining the threads for the securing nuts.

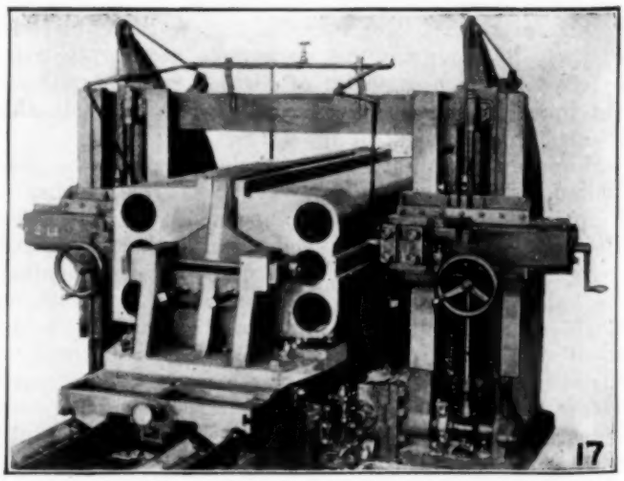
One Otis type-5 boring mill was used, the end of the boring bar being fitted with a boring head having two inserted carbon-steel step cutters turned and ground to the proper radius, so that the two diameters in the counterbore were finished in one cut. The end of the cutter head carried a loose bronze pilot ring to support and center the bar in the reservoir bore.

Revolutions of boring bar, 12 per minute. Peripheral cutting speed of 8⅞-in. diameter cutter, 27 ft. per minute. Feed was by hand, by means of an extended feed-worm shaft on which two handwheels were installed. Average time setting sleighs and counterboring both reservoirs, 2½ hr. This operation was combined with one other at the Arsenal so that the times cannot be compared. Lard-concentrate oil was used on cutters.

OPERATION 15

Removing surplus material from bottom of sleigh preparatory to forming is shown in Figs. 16 and 17.





FIGS. 16 AND 17. PLANING TWO FORGINGS ON A SPECIAL PLANER

Four Otis type-2 side head planers 49 in. between heads were used on this operation, planing two sleighs on substantial holding fixtures at one setting. The amount of material removed varied considerably with the forgings.

Cutting speed 30 ft. per minute. Return speed, 38 ft.

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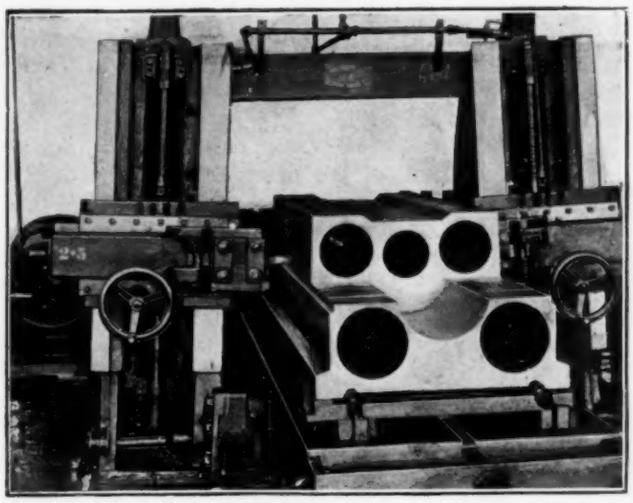


FIG. 18. SPECIAL PLANER WITH UPRIGHTS SET AT AN ANGLE

per minute. Average time of this operation including setting was 20 hr. Cutting compound was used on the tools. No record of Arsenal time on this operation.

The planers were also used for planing the slot underneath the gun clearance preparatory to finishing on type-11 milling machines. This work was finally done by milling on type-6, horizontal-spindle slab milling machine in operation 24.

The planer tables had worm and rack drive and each planer was operated by an individual constant-speed alternating-current motor through a countershaft from which the power was transmitted to the planer by means of reversing belts. An adjustable ratchet power feed connected both heads; the handwheel operation for the heads was connected to the feed through a worm and gear nut by which the heads could readily be moved by hand while the automatic feed was engaged.

Later experience with the so-called rotary planer heads, as used on Operation 1, indicated that the removal of surplus metal such as encountered in this operation, could be accomplished by that method in much less time and with a saving in power.

Operation 16

Finish planing both sides of sleigh to an angle of 87 deg. 30 min. from the horizontal is shown in Fig. 18.

Six Otis type-2 planers with housings set at the correct angle were used in this operation. Planer cutting speed, 30 ft. per minute. Return speed, 38 ft. per minute. Average time of operation including setting time, 9 hr. Cutting compound was used on the tools. Time at the Arsenal on this operation was 9.61 hours.

Before the installation of type-4 milling machines it was necessary to use planers to assist in removing the excess material on both sides of the sleigh in addition to taking the finishing cut.

Setting the planer housings at the required angle made it possible to locate the sleigh on the setting fixtures and plane both sides at one setting, thereby avoiding the necessity for setting the sleigh on an angle fixture, in which case only one side could be planed at a time. The housings were set to angle by inserting bevel wedges between the bed and housings. These wedges could be removed if necessary and the housings set vertically by installing a longer cross girt. The planers otherwise are the same as used on operation 15 except the distance between toolholders is 39 in. instead of 49 inches.

Operations 17, 18 and 19

Finish slab milling outside of three cylinder walls. Four Otis types-6 slab milling machines were used. Figs. 19 and 20 show two of these operations. Spindle revolutions, 9 per minute. Peripheral speed of cutters: Operation 17, 29 ft. per minute. Operation 18, 33 ft. per minute. Operation 19, 33 ft. per minute. Table feed 30 in. per hour. Average time setting and removing the sleigh and in milling the three operations, 9½ hr. Cutting compound used on cutters. The time on this operation at the Arsenal was 15.58 hours.

In the original planning of the machining operations on the sleigh, this method of removing the surplus material was decided upon in preference to planing, as it was believed it would result in saving in time because the fixed peripheral speed of the cutters, coupled with continuous cutting with a predetermined feed, would not be subject to the whim of the individual operator. The experience with slab milling in the several operations on type-6 machine was that their extremely heavy spindles and arbors and their worm gear drives eliminated to a marked degree the vibration and chatter inherent to spur gear driven machines, so that much time was saved by giving the milling machine its

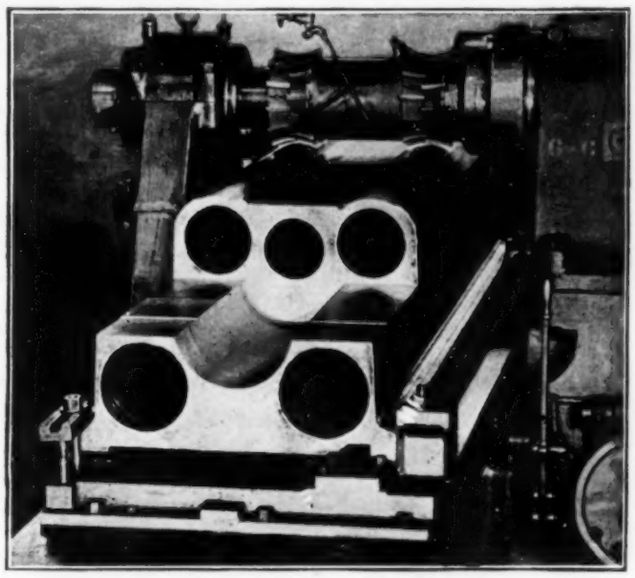


FIG. 19. RADIUS MILLING

fullest opportunity. Many sleighs were rough planed on the cylinder walls and cutters used for the finish cut only, as abundant planer capacity was available. However, a number of sleighs were milled with full depth cuts in these three operations, combining the roughing and finishing in one cut, with satisfactory results in workmanship and in cutter upkeep.

The reason for the "set up" of milling cutters in three operations was due to the original recuperator design which left a square pipe-boss at the end of the sleigh between one of the recoil cylinders and the recuperator cylinder. In operations 17 and 18, the cylinder walls were milled throughout their entire length. In milling the third section, in operation 19, the cutter was stopped upon reaching the line of the pipe boss. This lug was milled off on all the completed sleighs after the design was changed. Had the lug been

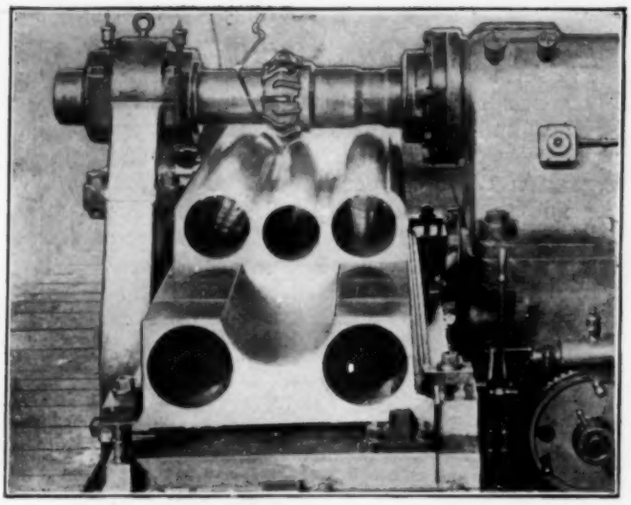


FIG. 20. ANOTHER MILLING OPERATION

omitted from the design in the beginning the three cutters would have been combined on one machine when used for finishing cut only, but if the work had been continued to the full contract completion, later experience would doubtless have led to roughing the walls in an earlier milling operation, instead of rough forming them on planers and finish them in a final operation.

The Cutter Grinder

The electric cutter grinder shown in Fig. 21 is partially balanced by a counterweight and is readily moved on the surface plate by hand. The cutter blade to be ground is made to bear on the vertical height gate *A*, then clamped on the arbor by the handwheel *B*. The adjustable hardened contact piece *C*, at the base of the grinder, is pressed against the hardened form plate *D* that is dowelled and bolted to the surface plate on a center line with the cutter. The shape of the grinding wheel is maintained by resurfacing with a diamond the holder of which is pressed against the contact piece *C*.

Operation 20

Planing both slide liner seats simultaneously, and in this operation it was customary to have one man work on each side of the planer. Three Otis type-2 planers, 39 in. between toolholders, were used.

Cutting speed 30 ft. per minute. Average time setting and removing the sleighs and machining, 11½ hr. Arsenal time on this operation was 20.61 hours.

A mixture of ten parts paraffin and one part lard oil concentrate was applied with a brush to the cutting tools.

Removal of the metal to form the seat for the bronze slide liners was a trifle difficult due to the interference of the outer lip and the need for the close machining tolerances on account of interchangeability of liners. Forming tools were used to insure accuracy and on a portion of the operation special toolholders with clappers set in vertical position were inserted in the toolheads to prevent interference with the tools on return stroke.

Operation 21

Fig. 22 shows the rough boring from solid of the semi-circular gun clearance throughout the full length of the sleigh, using boring head *A*, Fig. 23, on the taper end of the boring bar, preparatory to finish boring the taper gun seat in operation 23. The cutting tools in this head are set eccentric, the first cutter being set to 6$\frac{33}{64}$ in. radius and the last cutter 8$\frac{33}{64}$ in. radius, the eight intermediate cutters each being set to do their proportionate work.

Circular cutter *B* Fig. 23, was bolted on the first boring bar flange back of the eccentric head, the tools in this head being set to bore 9$\frac{1}{16}$ in. radius. The cut made by the circular cutter head stops at the forward gun seat.

Operation 22

Finish boring the gun clearance. For this operation it was more expedient to move the sleighs to other boring mills where circular cutter *B*, Fig. 23 with cutters set to bore 10$\frac{7}{16}$ in. radius was bolted on the first boring bar flange. A cutter head with cutters set to 10$\frac{1}{16}$ in. radius was bolted to the third flange and cutter head *A*, Fig. 24, with cutters set to 11$\frac{33}{64}$ in. radius, was bolted to the fourth boring bar flange. The cut made by the first cutter head stops at the forward gun seat. A liberal supply of cutting compound was used. Eight Otis type-7 boring mills were used for both operations. Boring bar revolutions 5½ per minute. Peripheral cutting speed of eccentric boring head, 25 ft. per minute. Peripheral cutting speed of largest diameter cutter head, 34 ft. per minute. Table feed 7 in. per hour. Average time setting and removing sleighs and machining, both operations, 26 hours. Arsenal time on operations 21 and 22 was 18.68 hours.

Operation 23

Finish boring the gun-seat taper in the forward end of the sleigh. Taper boring head *B*, Fig. 24, was used, the table remaining stationary and the toolholders in the taper head were fed into the cut by means of the star on the feed screw. Circular cutter head *A*, Fig. 24, fitted with four 45 deg. angle cutting tools, was bolted to the rear boring-bar flange and was used for facing the chamfer in the gun-clearance bore at the forward line of the breech pocket.

Two Otis type-7 boring mills were used. Boring bar revolutions, 5½ per minute. Peripheral cutting

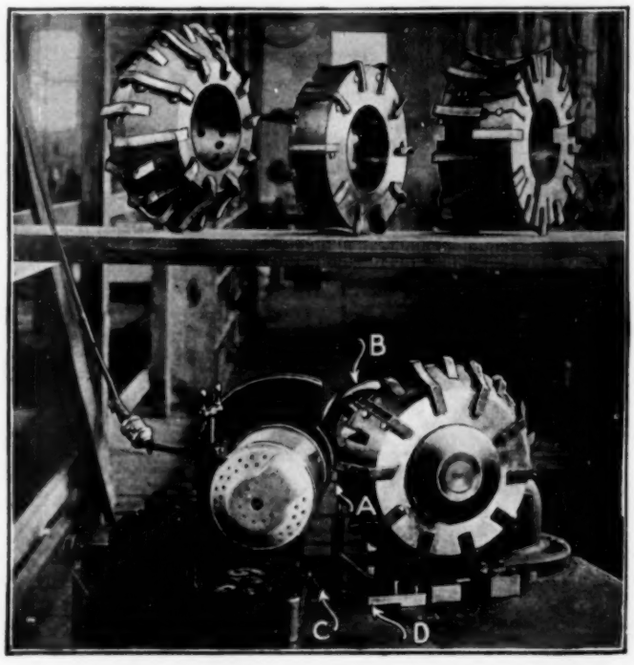
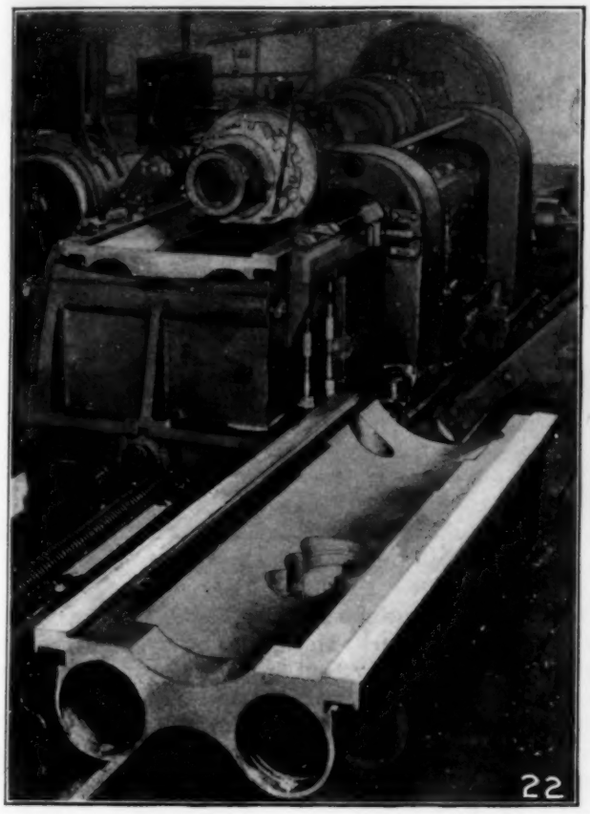
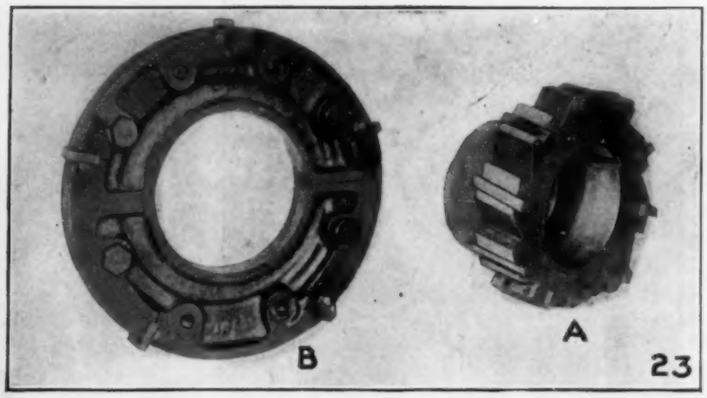


FIG. 21. GRINDING AN ANGULAR CUTTER





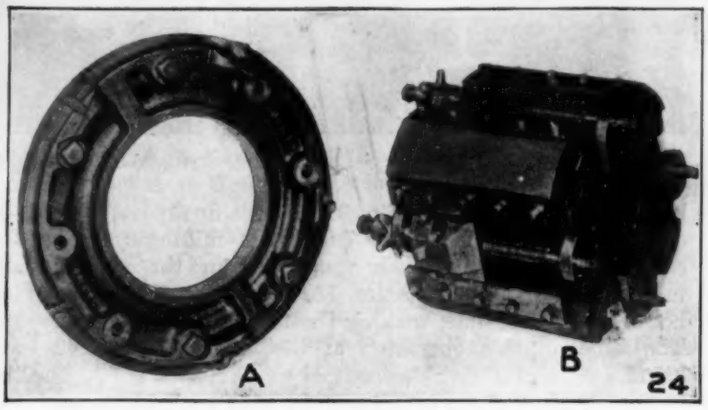


FIG. 22. BORING THE GUN CLEARANCE. FIGS. 23 AND 24. CUTTERS AND BORING HEADS

speed of the circular cutter head was 34 ft. per minute. Average time setting and removing sleighs and in machining, 2½ hours. Arsenal time on this operation was 6.33 hours.

Operation 24

Milling away portions of the metal for a length of 43½ in. at the reservoir end of sleigh to partially compensate for the overhanging weight of the Howitzer. One Otis type-6 milling machine was used. Revolutions of spindle, 8½ per minute. Peripheral cutting speed of 14½-in. diameter cutters, 31½ ft. per minute. Table feed, 22 in. per hour. Average time setting and removing sleighs and machining, 2½ hours. Arsenal time on this operation was 9.91 hours.

This operation was originally done on vertical spindle milling machines where the average time was 12 hr. A slight modification in the design of the slots to be milled made it possible to do the work on horizontal spindle milling machines with slabbing cutters and resulted in considerable saving of time. In this operation as in all others on type-6 milling machines, it was customary after grinding the cutters, to raise the hardened setting plates on the holding fixtures to compensate for the reduction in cutter diameter.

Operation 25

Milling 7⅛-in. wide slot from the breech end to the taper gun lock at the front end of the sleigh is shown in Fig. 25.

One Otis type-6 slab milling machine was used in this operation. Spindle revolutions 6 per minute. Peripheral cutting speed of 20½-in. diameter cutters, 32 ft. per minute. Average time setting and removing the sleigh and in milling the slot which had previously been planed was 2¾ hr. To this time is to be added 3½ hr. for planing the 5-in. slot, making 6¼ hr. total average time to rough and finish mill the 7⅛-in. slot. A liberal supply of cutting compound was used. This operation as performed at the Arsenal was included with four other operations so that the times can not be compared.

The milling cutter used in this operation did exceedingly good work, and this method of machining the slot was more satisfactory and less expensive than by rough planing and through finish milling on vertical milling machines, as the work had previously been done. The cutters in this milling head, as in all other cases where large surfaces were being machined, had grooves ground into their cutting faces to break the chips and prevent chatter. The grooves were ground spirally with the cutter head, leaving perfectly smooth finished surfaces on the work.

Operation 26

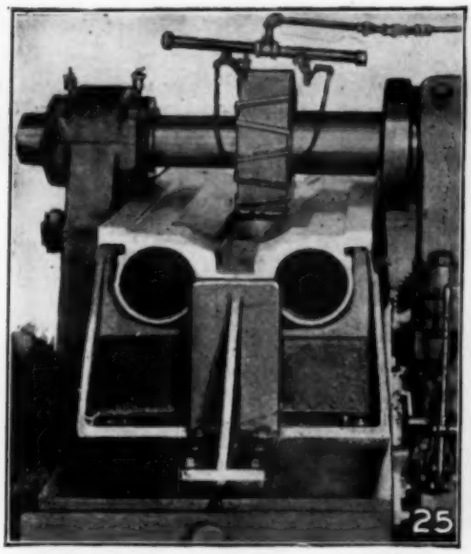
Drilling three 7⅜-in. holes, forming a pocket in the middle of the sleigh underneath the gun to reduce the weight of the recuperator is shown in Fig. 26. Three Otis type-5 horizontal boring mills were used.

Boring bar revolutions 17 per minute. Peripheral speed of 7⅜-in. diameter drill, 33 ft. per minute. Boring bar feed, 6 in. per hour. Average time setting and removing sleigh and boring the three holes after 7⅛-in. slot had been milled, 4½ hours. The time for this operation at the Arsenal was 14.83 hours.

Operation 27

Fig. 27 shows milling the outside walls of recoil cylinders over that portion which was left unfinished in operations 17 to 19. Two Ingersoll vertical spindle milling machines were used. Revolution of cutter spindles, 25 per minute. Table feed, 45 in. per hour.

Machining a number of the sleighs required 18½



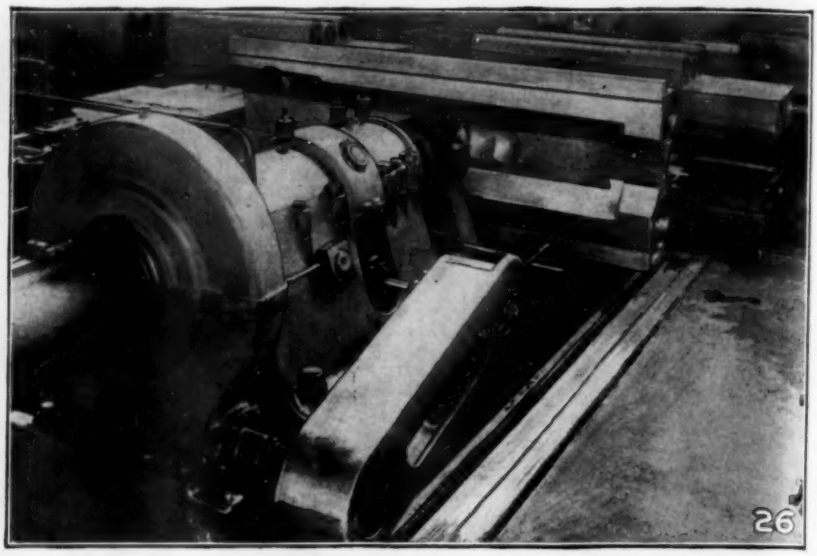


FIG. 25. MILLING A WIDE SLOT. FIG. 26. DRILLING TO REDUCE WEIGHT

hr. for this operation. This time was finally reduced on an average, for setting and finish milling in one cut, to 7¼ hr. by previously rough planing the corners in conjunction with operation 16, which required three hours additional time, making the total time 10¼ hours. The time on this operation at the Arsenal was 8.68 hours.

The sleigh was set in holding fixtures with hardened steel locating plates, the fixtures being doweled and bolted to the milling machine table. The depth of the milling cut was fixed by the hardened circular disk, forming a tool setting gage; this gage was also doweled and bolted to the milling machine table in correct relation to the holding fixtures thus insuring uniform thickness of cylinder walls, as the sleigh was set in similar holding fixtures on the boring mills where the cylinders were finish bored and reamed.

Operation 28

This operation consists of milling the outside cylinder walls of both reservoirs and is similar to operation 27. Three Ingersoll vertical spindle milling machines were used.

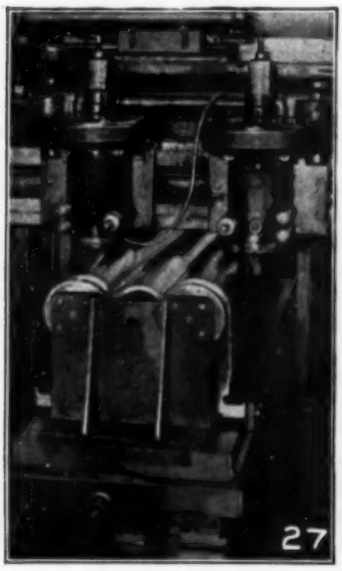
Revolution of cutter spindles, 25 per minute. Table feed, 36 in. per hour. Machining of a number of the sleighs required 35 hr. but in the later developments, increasing the cutter speed and feed resulted in finally reducing the time for setting and milling, making the average time 17 hours. The time on this operation at the Arsenal was 10.52 hours.

Holding fixtures and cutter setting gages were used on the machine tables for this operation, same as in Operation 27.

Operation 29

Fig. 28 shows completing the milling of that portion of reservoir walls left unfinished by the Ingersoll milling machines in Operation 28 due to large diameter of the milling cutters. One 45-deg. angle portable milling-machine was used for this operation. Average time on milling both reservoirs, 6 hours.

It was originally intended to chip away the surplus metal with air chisels. This did not prove satisfactory and the portable milling machine was designed for the purpose. The machine was held in position by an expansion sleeve extending into the reservoir bore



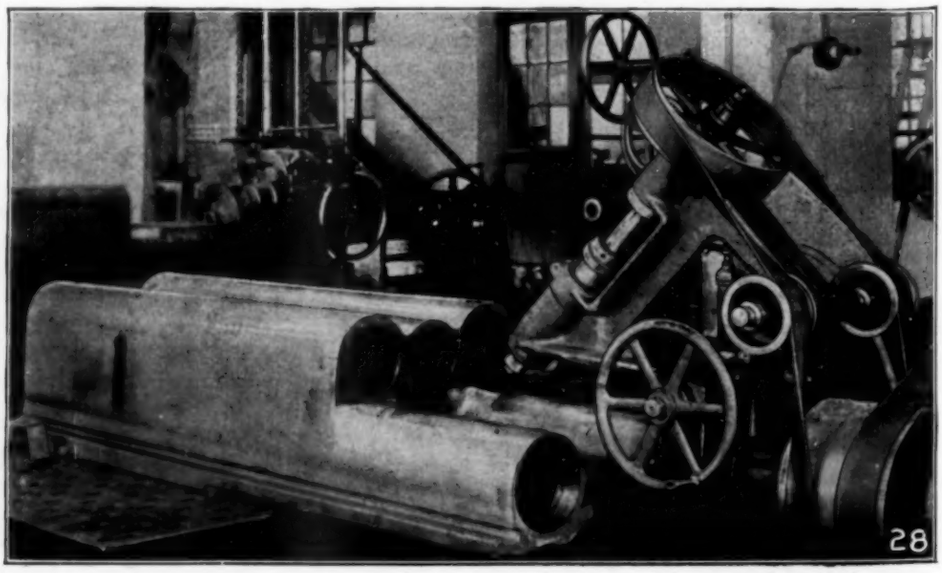


FIG. 27. MILLING OUTSIDE OF RECOIL CYLINDERS. FIG. 28. AN ANGULAR MILLING DEVICE

clamped by means of the handwheel at the pulley end of the shaft which actuated wedges in the sleeve. The entire frame was then rotated by means of the handwheel at the end of the wormshaft. The worm meshed into a worm gear keyed to the sleeve and the operator in revolving the handwheel moved the frame in a semicircular arc. The work in this operation was done at the Arsenal by chipping and filing and the time was 38.28 hours.

OPERATION 30

Rough milling the locking wedge pocket in the breech end, the forward gunlock and the center pocket. Fifteen Otis type-11 milling machines and three Otis type-12 milling machines were used.

Spindle revolutions for type-11 machines, 45 per minute. Peripheral speed of 4¾-in. diameter cutter, 56 ft. per minute. Average time of this operation on the first 120 sleighs was 129 hr. This was reduced to an average time of 60½ hr. on the next lot of 164 sleighs by training operators in the correct use of the various cutters and in limiting the portion of the work performed by each man. The operation was divided into three sections:

(A) The first setting consisted of rough-milling the entire breech end to the depth of the first shelf. The sleigh was then moved to another machine for another partial operation.

(B) The second setting consisted of rough-milling the breech end and bridge to within ⅛ in. of finished dimensions; a partial operation.

(C) The third setting consisted of rough-milling the forward gunlock and finish milling the center pocket.

A liberal supply of cutting compound was used on the cutters. Average time for the complete operation on ten carbon forging sleighs was 47½ hr. and this time would doubtless have been further reduced if the work had continued. The time on this operation at the Arsenal was 102.02 hours.

The milling cutters used in this operation were designed by Mr. Kirchenbauer after various attempts had been made to economically remove the large mass of metal with regular cutters.

The cutter shown in Fig. 29 was made spirally, like a hob with round nose cutting edges, making a strong hog nose tool with small chip space and it proved to be an excellent tool for removing the metal rapidly.

Foreign Buyers and the U. S. Dollar

Discussing the subject of foreign exchange and its influence on American business, Malcolm Stewart, manager of the Cincinnati Chamber of Commerce Foreign Trade Department, says, in the *Cincinnatian*, the official publication of the Cincinnati chamber:

"The matter of foreign exchange presents many difficulties in the way of commerce between nations at the present time. A very unfavorable impression has been created towards the United States in certain foreign countries, because the currencies of these countries have depreciated to such a point that it appears impossible to make any purchases. However, this is not the truth. When hard times come a large number of business men get a grouch, become discontented and look around for something to blame it on. The importer in those countries which have depreciated currencies, seems now to have the desire to blame it on the high price of dollars, when as a matter of fact, dollars are not high priced. The only trouble is that the paper money in the country of the foreign exporter is cheap.

"A great many American manufacturers have aggravated the situation above mentioned by making all quotations in United States dollars. The foreign buyer is peeved very greatly over the fact that his own money is not worth much and it takes so much of it to buy the dollars that he feels like cussing, and the most convenient thing to cuss at the moment is the dollar exchange. By a very simple process he could be switched off and made to cuss his own paper money.

"For example, gold is gold the world over. Any manufacturer of America who receives a request for quotations can immediately ascertain information from his bank what the equivalent of the American valuation would be in the gold coin of the country from which he receives the inquiry, and he could at once quote the foreign buyer in the gold money of his own country. Then, if it is necessary for the foreign buyer to put up paper money to buy the gold coin, he would immediately begin to rave about the cheapness of his own paper money in comparison with the metal and think nothing further of the difference between his paper and the good American dollars.

THE VALUE OF PAPER

"When we come to a full knowledge of the fact that paper is not a value and that it is only good in so far as it represents real value, we will readily understand why certain foreign currencies are so greatly depreciated. There is a limit to the amount of money that a printing press can turn out and still is accepted at its face value. Therefore, if prices are fixed the world over in gold, the American manufacturer need have no fear whatever of competitors from countries which have depreciated currencies if he will make his quotations as above outlined in the money of the country in which he wishes to sell. He will do more business, because a foreign buyer will more readily see that the American prices are right; and taking the quality of the goods into consideration he will be able to buy in the United States as cheaply, or in some cases, more cheaply than in European countries."

Are Hollows Worn in Hammer Handles by the Fingers of the User?

BY E. A. SISSON

Replying to L. L. Thwing's article under the above title which appeared in the *American Machinist*, Vol. 54, page 980, I wish to state that I have a Millers Falls hacksaw frame on which the bead on the wooden handle next to the ferrule has been worn five sixteenths of an inch by the thumb while using. This particular frame has been in use twenty-five years and aside from the wear mentioned is in perfect condition.

In the plant of C. B. Cottrel & Sons, Westerly, R. I., there was employed over thirty years ago a man, Jack Booth by name, whose duty it was to chip and file racks used in presses which the company manufactured. Booth had done this work for years and the imprint of his fingers was worn into the handle of the hammer he used to a degree that was astonishing.

Undoubtedly there are a few old-timers who remember Booth and his hammer, and as far as my knowledge goes Bill Andrews or Fann West will remember the writer and vouch for his statement

Ethics of the Machine Shop

By John S. Watts

There have been frequent references of late, to the increased efficiency of all classes of labor, especially since the demand for labor fell off, and from all sides we hear it asserted that since jobs are hard to find, the output of the individual worker has increased considerably over what it was when men were scarce and work plentiful. I have not heard of the statement being denied by any of the representatives of labor, and I am sure that its truth will not be disputed, as the facts are too widely known and too easily checked, to be denied.

This conduct, especially on the part of the skilled trades, has led me to study the morality of such actions, and in my opinion the question is deserving of deep consideration from all interested in the advancement of the mechanical arts.

The immorality of this conduct lies in the giving of as little work as possible for as large a payment as can be secured, and still hold the job. The majority of those guilty of this conduct do not, I believe, give much, if any thought to the rights and wrongs of the question, and those few who do defend it upon the ground that they do, even when slacking in good times, return full value for the pay they get, and that in bad times they work harder because compelled to do so by the competition of their fellow workers.

Examining this defence that the smallest day's output is equal in value to the wages received, we find that we have no real criterion on which to base the value of any man's work, except by comparison with what others receive, and the value of the others' work, in terms of money, is equally hard to evaluate. The only trade that seems to offer a possibility of fixing the unit value of an hour's labor in actual wealth in goods is the agricultural, where it can be determined with some degree of exactitude how many hours of labor plus a fixed degree of skill will produce an average quantity of wheat or other food.

However, this defence that the lowest rate of production given is fair value is not admissable, for the reason that when a man accepts a given hourly rate for his labor, there is an implied, if not an actual, contract, that he will give in return the best value of which he is capable.

That a rate less than it should be may have to be accepted under the compulsion of poverty is not justification for giving less work in return. Let the man who thinks so imagine a parallel case, such as the storekeeper, who because of a falling off in the demand for his goods is compelled through need of money to sell his goods at less than they cost him. If our friend ordered five yards of cloth from this merchant at the reduced price, he would consider it robbery if the merchant palmed off only four yards on him, or substituted a cheaper quality, and would be highly indignant if his own argument that value equal to the money tendered was used by the merchant.

The very machinery which the slacker has worked on in hard times is often sold by his employer at less than its actual cost, because of the absolute necessity of the employer finding money to pay his employees with. A manufacturer, who in such cases attempted to supply a machine in any way inferior to those sold at the higher prices, would not stay in business for any length of time.

In both of the above parallel cases it is demonstrable that the money received is less than the value of the services rendered, that is, the storekeeper or manufacturer, selling at a loss, receives no salary whatever for the time spent in handling the goods, or for the use of his capital and plant. In the case of the employee, he would be hard put to it to prove that the lowest pay he received was not equal to the value of his labor. Not that I would assert that it is, but simply that it is impossible to absolutely prove that it is not.

Although if the skilled mechanic, or even a laborer, will compare the hours he works and the conditions under which he labors, with the hours and difficulties of a skilled farmer, and the relative remuneration of each, I think he will be at least doubtful as to whether he is giving full value in return. Then again, the farmer has to wait a year to know what his remuneration will be, because while he does actually produce a measurable value of material, what he will get for his surplus after feeding himself and family is an unknown quantity, depending to a considerable extent upon the wages paid to the town workers who manufacture the clothing, fuel, machinery, etc., which he must purchase. On the other hand, the town people, being paid usually weekly, or monthly, can estimate closely the value of their wages in necessities, as the prices do not vary so much in that short space of time as they will in a year.

It is only natural, that in making out a case for an increase the wage earner should choose for comparison that other occupation which appears to be better paid than his own. This procedure, however, leads in an unending demand from first one and then another trade for adjustment, and will never produce a final decision. Therefore it should be discarded, and in its place, the remuneration received by the workers in some basic trade, such as agriculture, should be used as the fixed unit, to be used in calculating the fair wage for all classes of labor.

To loaf on the job because of a feeling that one's trade, or class, is not receiving its fair share in the distribution of wealth, is simply to defeat one's own object, as the less wealth produced, the less there will be to be distributed, and in the end the weaker will be still less able to enforce their demands. If the machine-tool manufacturers decided they were not receiving sufficient pay for their work, would they sit back and take it easy, and let the output look after itself? I think not.

Evidently, then, this slackening of effort, accompanied by demands for higher remuneration, is characteristic only of the wage earners in factories, and as it would be absurd to suppose that they are any less moral than other classes of the people, we must look deeper for the motive for this action. The difference, I think, lies in the fact that a manufacturer is too far sighted to attempt to do anything so crude and useless, as to cut down the quality of his product to match a temporarily lower price. The most successful method he has is to increase the value of his product beyond that of his competitors, and by so gaining extra trade, be enabled to recoup himself for his extra ability and work. This method takes time, patience and perseverance, but is in the end the most universally successful, and is the only one that will bring the factory employees that higher living which everyone is willing and anxious they should have, but

which in the final analysis, must be earned by themselves.

The idea they must digest is, that in the case of all successful movements success was earned by strenuous efforts over a long period of time, before it could be enjoyed, as in this world one must look far ahead and not expect immediate reward for every little thing we do, over and above what is actually expected of us.

The fear that any additional effort on the part of the employee simply adds so much more profit to the employer, is one that must be eradicated by intelligent leadership of labor. Granted that at first the additional output so gained will revert largely to the employers benefit, it must be remembered that we cannot gain ourselves without profit to others, as we are all interdependent upon each other's efforts. The long view must be taken, that a factory filled with efficient workers will never need for profitable work. That the only sure criterion of the value of our work is the profits made by the company employing us. That the dividends paid by almost all companies are public, and well known, and it is not difficult to decide the point when capital is getting over its share of the profits. That a continuously successful company will be only too glad to share its prosperity with its employees, and cases are numerous where this prosperity has been shared with the employees.

If your complaint is that some other employee is getting more than he ought to, why not train yourself for his job. You will get it if you go about the matter with energy, and when you do, you will, I think, decide he was earning every cent he got; and if the man who gets your old job, does not do any better at it than you did yourself, there will be some comments from you about it. Such is human nature.

A Nut Castellating Fixture

SPECIAL CORRESPONDENCE

The nut castellating fixture used in the Peerless plant and shown in Fig. 1 is mounted on a No. 12 Brown & Sharpe plain milling machine. Fig. 2 shows the details, this fixture being arranged to handle from ½- to ⅝-in. hexagon nuts.

The nuts are placed in the charging tubes at *A*, Fig. 2, which are filled before the machine is started. The pulley *B* drives the shaft *C* which in turn, drives the gears *D* and *E*, which can be changed to alter the feed if necessary. The gear *E* drives the shaft *G* on which are mounted the cams *F* and *F*. These cams work against the rollers *I* and *I*, mounted on the nut plunger *H*. This plunger pushes the nut out of the tubes *A* and into the tracks *J*, beyond the back plunger *L*.

This is completed at one revolution of the cam. The spring *K* then pushes the plunger *H* back to the starting point ready to take other nuts and the cams again push the nuts into the tracks. This is continued until the first nut reaches the slitting saws at *Q*. Here the nuts are all in line in tracks *J* and as the cams revolve they force one nut into each track. This action in turn forces the nuts under the cutters *Q*, mounted at *U*.

After the first slot is milled in the nuts are again fed into the charging tube *A* being turned in the proper direction to have the second slot cut. The third slot is cut in the same way.

The table *O* is for convenience of the operator on which he can place a pan of nuts. It will be noted that the fixture is set on an incline to assist in draining the water away from the mechanism and prevent its working up into the various parts. The tracks *M*, *N*

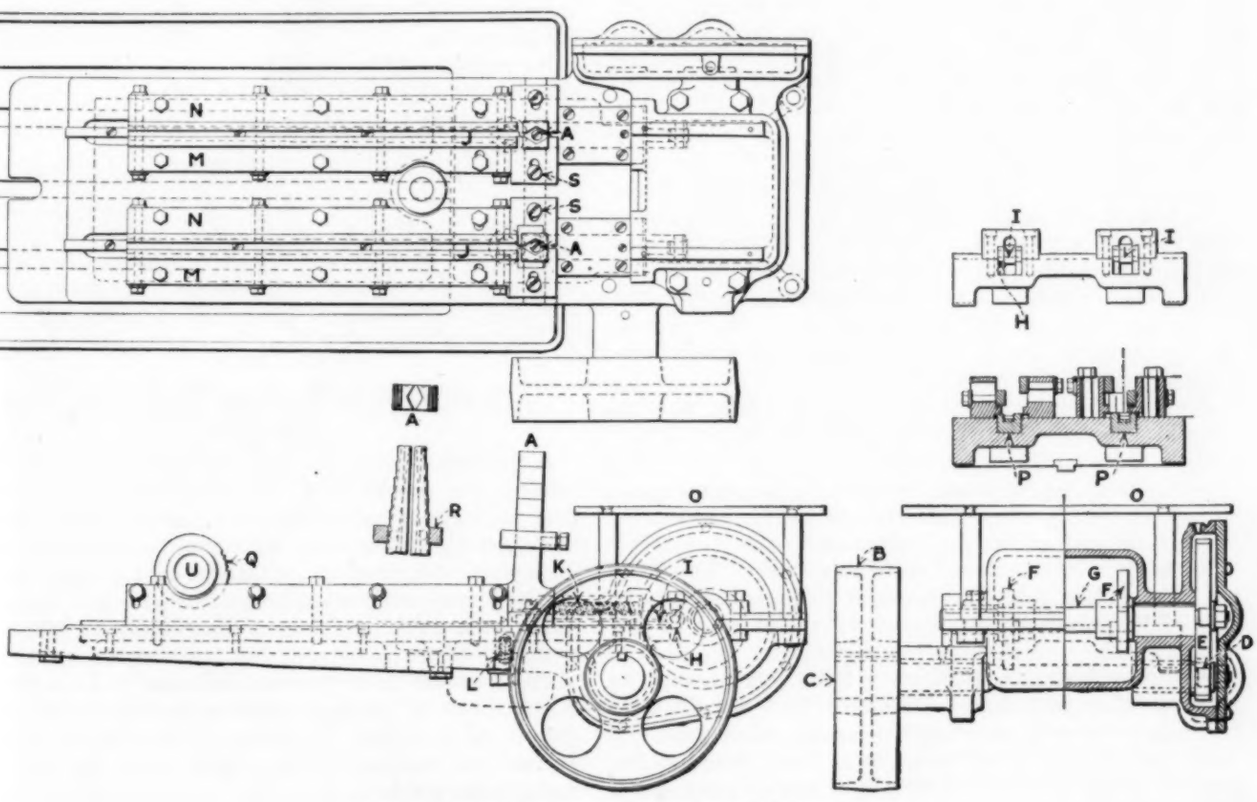


FIG. 2. DETAILS OF THE MILLING FIXTURE

and *P* are hardened and ground. In changing to the different size hex nuts, the collars *R* are loosened by means of setscrews and set to the different spaces

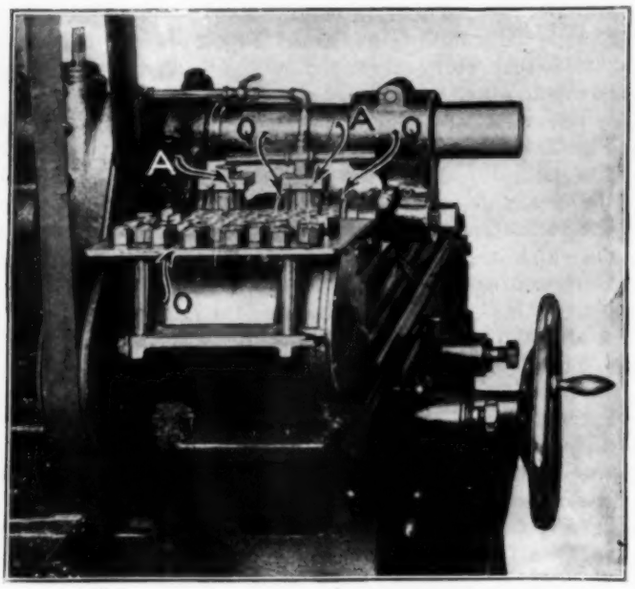


FIG. 1. MILLING MACHINE EQUIPPED FOR CASTELLATING NUTS

shown in the charging tubes *A*. The tracks are also adjustable to accommodate the different sizes of nuts. As shown, the machine is set for ½-in. hex nuts.

Maintaining Harmony in the Shop

By Robert Mawson

The article by R. A. Schultz on page 1125, vol. 54, of the *American Machinist* is of timely interest and states very clearly the condition existing in many machine shops today. In most shops and drafting rooms when a new man enters he is scarcely ever shown the "ropes" and the result is that much time is wasted both for the man and the concern in preliminaries.

The correct method is to consider that the new man is one of the family—one of the bunch if you want—and make his advent as congenial as possible. It is usually hard enough to break into a new shop without the men working alongside of you adding to your troubles.

With this in mind the new man should be shown what is the particular practice followed there as regards, say, finish on machined parts, as almost all plants have their particular desires and demands.

A case in point may illustrate this: a man went to work in a certain shop and was given a part to machine in the milling machine, and told to make a good job. He did so, using the practice followed in the shop where he had previously worked, machining the part to within a thousandth of an inch of actual size.

When the job was done the foreman said, "You were too long on that job, Bill, we don't make watches here. A good job means within a sixty-fourth of an inch and none of that Swedish gage surface either."

Now the fault was both with the foreman and the men working with Bill. Either or both should have told him what was their practice as regards a good job. Such information given would have made the man feel at home and prevented lost time on the machining operation.

Similar methods should be followed in the designing department. It is a good system to have a book of standard practice to be given to the new men so that they may see what to follow. Some plants insist on certain sizes of fillets for walls of castings of a given thickness; studs and bolts of certain sizes to agree with determined conditions, and these are not always governed or controlled by stresses in machine but are standard practice of this concern and the only way the new man can know about them is either by being shown or wasting time to find them out. It would be better for both parties if he were shown when he started on the job.

The same applies to the tool designer. Let him see how you prefer to do things at your shop and then if he can offer any suggestions the firm will profit accordingly, but if you forget to get him started right and he makes designs contrary to your practice, don't think he is a damphool for the shoe is on the other foot.

One feature not mentioned by Mr. Schultz might be brought out here, namely, the questions asked in advertisements for men sometimes seen in technical magazines or on the application blanks as to what religion or secret order you belong to.

Now for a fair question: Does it make me a better machinist or designer if I go to a certain church or do not attend any? And again: Suppose that I walk around with regalia from secret orders until I look like a comedian. Does that help me to be a better designer? Certainly not. "Meeny, meeny mini-mo" obtained from any order does not help me in figuring out stresses in machine parts.

I recall what a friend told me about going to work in a machine shop. The first week he was asked by the foreman what church he attended and when he said he had no particular preference, he was advised to go to the "Blank" church as the president of the company attended there and by so doing he would stand in better for promotion.

He replied that he came there to work as a machinist and that Sundays were not included in the arrangement and he rather thought he would attend any church he desired.

In conclusion therefore give the new man all the help you can. He needs it. Don't be too nosey as to how he spends his time out of the shop so long as he is on the job and in good condition for the week's work and the man will be happy and contented and harmony will not only be obtained, but what is of more importance will be maintained as well.

A Convenient Tool for Oxy-Acetylene Cutters

A convenient tool has been devised for use in determining the proper tips and pressures to be used in cutting metal of different thicknesses with the oxy-acetylene blowpipe. The tool is in the form of a scale graduated in inches and quarters, and having the size of the blowpipe tip and the pressure of gas to be used with the greatest economy indicated at the left of the graduation.

Some makes of blowpipes differ as to both the economical size of tip and pressure to be used in cutting metals of specified thickness. The tip and pressure indications suiting the apparatus made by two large manufacturers have been marked on opposite sides of the scale.

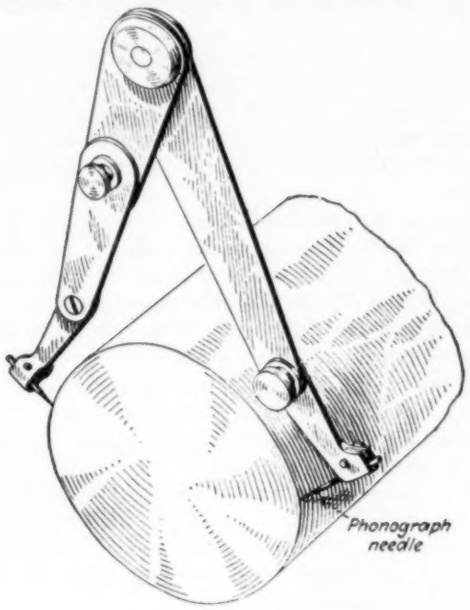
Ideas From Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Divider for Round Work and for Large Radii

BY W. C. BETZ

To space or divide a round piece of work for drilling the divider shown in the illustration will be of value, as no small tool now on the market covers this need. To set the tool the legs are approximately adjusted to



DIVIDER FOR ROUND WORK

the chord of the arc to be spaced and the scriber points swiveled to a radial position; the tool may then be set exactly to the chord by measurement or by trial around the circumference of the work.

The tool will also be of service as a divider of large scope by the introduction of an extension, which may be of any length to suit conditions. The tool may also be used as an inside or outside caliper by reversing the needles as contact points.

Plaster Casting for the Machine Shop or Factory

BY HOMER S. TRECARTIN

A young mechanic, new to our shop, showed us a money saver the other day. We needed a pattern in a hurry for making a casting of a part of a special machine. The superintendent had made a sketch of the part and was telephoning to find a pattern shop which could make the pattern the same day. This new boy heard the superintendent, and asked to see the sketch. He studied it a moment, then said, "I'll make you a pattern for that in two hours."

The sketch was turned over to him with much skepticism, but he made good his promise, and I got him to tell me the details of his method.

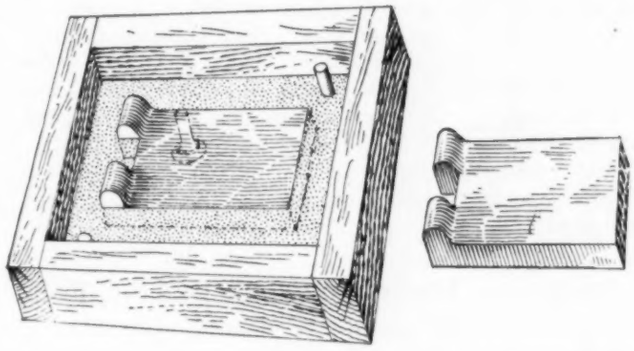
The boy made the pattern of plaster. He had worked sixteen months in a plaster-casting establishment and knew the tricks of the trade. He bought a double handful of modelers' clay for ten cents and two pounds of plaster of paris for twenty cents.

Working on a smooth flat board on the bench, he made a model with the clay the size and shape of the part to be cast. This took him twenty minutes. He took a small wooden box and placed the model in the bottom. Then he prepared the plaster. He put about a pint of cold water in a tin basin, and sprinkled evenly into it as much plaster as would absorb the water, so that the plaster came to the surface of the water but not above it. This was then stirred slowly with a spoon for fifteen or twenty seconds, until it became like thick cream.

This liquid plaster was poured into the box around the clay until it rose evenly to the middle of the model or "parting line." What remained in the bowl was thrown away and the bowl rinsed out.

Before the plaster had "set" two short ¼-in. dowels were stuck perpendicularly into opposite corners and left projecting, and two little clay cylinders were stood on the model to form a "gate," for pouring, and an "air vent."

He then mixed up a little soap in some warm water and, as soon as the plaster was hard (about ten minutes after pouring) he painted the surface of it all over with the soap solution. After this dried, he brushed it over lightly with thin oil. Then another pan of plaster was mixed and stirred and poured in like the first until



THE CLAY MODEL IN THE LOWER HALF OF THE MOLD

its surface was about ¼ in. above the highest part of the model.

After waiting about twenty minutes, the sides of the box were carefully pried apart and removed. The edge of a chisel was gently worked into the "parting" line of the mold and the upper half was lifted off. The clay model was dug out, with care not to injure the still soft plaster, and the mold was cleaned out with water and a soft brush.

Then the inside of the two halves of the mold were painted thoroughly with the soap solution, and lightly

oiled when the soap had dried. The two parts were then fitted together; being located by the dowels.

Now a third batch of plaster was mixed, a little thinner than the first, and was at once poured into the "gate" hole in the mold.

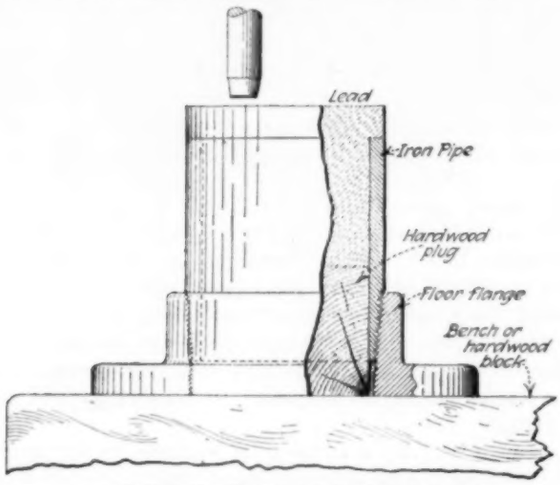
The cast was allowed to set for thirty minutes before the mold was removed. Only a slight tapping on the mold was needed to loosen it from the cast.

This method is simpler in practice than it sounds in the telling. Its use can be made especially economical in experimental work, where a clay model of a part may be made more readily than a drawing.

Bench Punching Stand

By H. H. Parker

The sketch shows a useful contrivance which may be screwed to the workbench or to a hardwood block and used for punching and similar work. A length of 2-



A PUNCHING BLOCK OR SOFT ANVIL

to 3-in. iron pipe, threaded at one end, is sawed off and the cut end trued up, then screwed tightly into a floor flange. A strip of sheet iron is bent around the top of the pipe and wired on so that it will extend about ¾ in. above the open end. Then the pipe is filled with molten lead or old babbitt metal even with the top of the sheet-iron mold, which is removed when the lead has cooled. In order to conserve lead, the lower part of the pipe may be filled with a hardwood plug.

If this punching face becomes marred from usage it is an easy matter to drive or melt out the lead and pour over again.

A Device for Fluting Wobbler Ends of Rolls

By Martin H. Ball

The accompanying drawings show a device designed for fluting the wobbler ends of rolling mill rolls on a 48-in. McCabe engine lathe. The rolls were made from forgings of an especially strong grade of steel. The device is also suggested for use on castings where trouble is experienced in getting the wobbler ends true enough by the casting method.

The boring bar is screwed onto the end of the lathe spindle and the roll is clamped on the cross-slide of the lathe carriage, as shown in Fig. 1. The locating block *A* is made to the proper height to bring the center of the roll to the height of the spindle center and is fastened to the cross-slide with two bolts *C* and *C'*.

The clamping block *B* is held in place by the two bolts *D* and *D'* which pass through locating block *A* and into the cross-slide *E*.

Both these blocks are made of hard wood. The block

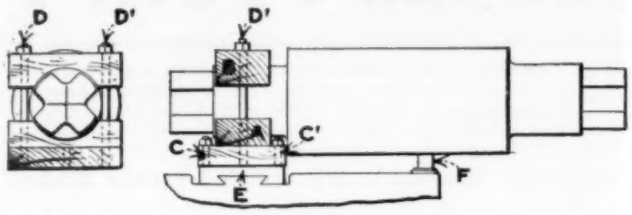


FIG. 1. HOW THE ROLL WAS MOUNTED IN THE LATHE

A is made of two pieces nailed together, the grain in the lower piece running at a right angle to that in the top piece. The bottom piece is wide enough to be attached to the cross-slide *E* with the two short bolts *C* and *C'*.

A parallel piece *F* is packed to the proper height and bolted to the extreme end of the carriage to support the overhanging part of the roll, and affords a smooth top surface over which the roll easily slides when operating the crossfeed screw to set the roll for the depth of cut to be taken.

The regular longitudinal feed of the lathe is used for feeding the roll along to its cut. It is advisable to take the cut on the back side of the roll as this brings the thrust of the cut downward.

In cases where the fluted part is very long in proportion to the length of the roll, a holding down strap may be required on the roll over the parallel *F*. The vertical and horizontal lines shown on the end of the roll are placed there for convenience in setting the roll to the four positions required.

Attention is called in Fig. 2 to the interlocking feature of the cutters which positively determines their position radially. They are held firmly against their backing and prevented from moving endwise by the four setscrews shown.

The cutters have no adjustment for wear as on this class of work there is a rather large tolerance for the

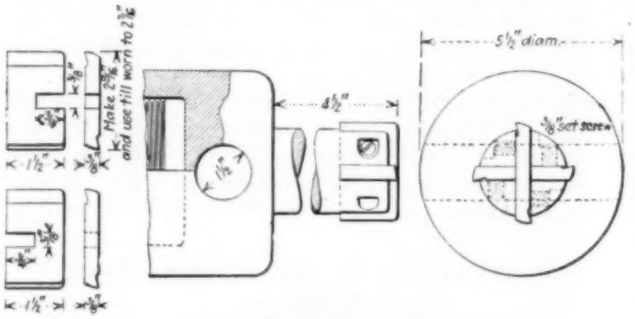


FIG. 2. THE CUTTER BAR AND CUTTERS

radius, thus giving the cutters a long life. The 1½-in. crosshole through the bar is for convenience in turning the bar on and off the spindle.

Changing Sizes of Cone Pulleys

By Franz Szabo

It is oftentimes desirable to change the speed ratios or to add new steps to existing cone pulleys in order to obtain additional speed ratios. To obtain the desired result "Kent" gives Dr. R. Burmester's graphical method. Following the directions as given, one

encounters some difficulties when changes in present cone pulleys are desired. The directions for using Dr. Burmester's method as explained in this article will eliminate these difficulties.

Let us assume for example a pair of pulleys, 6 in. in diameter for the driver, and 12 in. in diameter for the driven, and we wish to add one step to each pulley to get a speed reduction of $1\frac{1}{2}$ to 1. The center distance

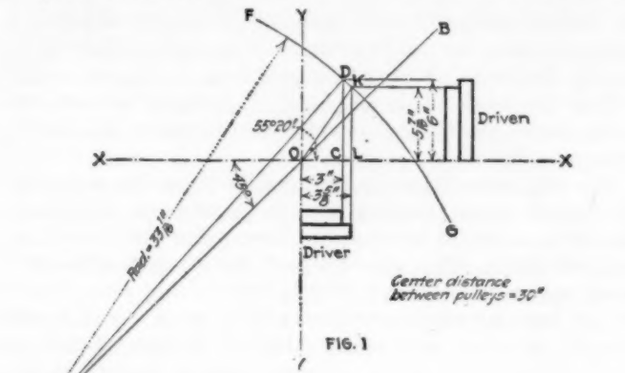


FIG. 1

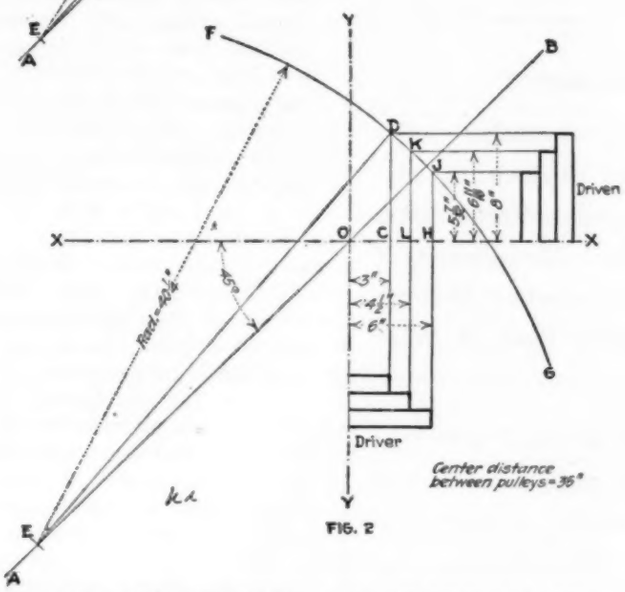


FIG. 2

DIAGRAM FOR CHANGING SIZES OF CONE PULLEYS

between the pulleys to be 30 in. It is desired to find the diameters of the new pulleys using the same belt.

Solution: Draw axes *XX* and *YY* intersecting at *O*, Fig. 1. Through *O* draw line *AB* at angle of 45 deg. to axis *XX*. On *XX* lay off distance *OC* equal to the radius of the 6-in. pulley, or 3 in., to some scale, the larger the better, and erect the perpendicular *CD* equal to the radius of the 12-in. pulley, or 6 in., to the same scale. Then with *D* as center, intersect *AB* at *E*, making distance *DE* to the same scale equal to 1.118 × center distance between pulleys, or 1.118 × 30 = 33.54, say $33\frac{9}{16}$ in. With *E* as center draw arc *FDG*. Angle *KOC* is then laid off, its tangent being equivalent to the desired ratio of the new pair of pulleys, or 1.5 in this case, the angle being 56 deg. 20 min., approximately. From *K* drop a perpendicular to *L* and the new pulley radii are represented by *OL* and *LK*, which are $3\frac{5}{8}$ and $5\frac{7}{16}$ in., making the diameters $7\frac{1}{4}$ and $10\frac{7}{8}$ in. respectively.

Another example: It is desired to reduce the feed of a certain machine having a pair of three-step cone pulleys by adding 4 in. to that step of the driven cone pulley giving the lowest feed. The diameters of the driver being 6, 9, and 12 in., and the diameter of the largest step of the driven being 12 in. before changing. What are the new diameters of the driven cone pulley so that the same belt will fit all three steps?

Solution: Draw axes *XX* and *YY*, and diagonal *AB* as previously explained. Then, as shown in Fig. 2, lay off *OC*, *OL*, and *OH*, representing to the largest scale possible the radii of the driver, 6 ÷ 2, 9 ÷ 2, and 12 ÷ 2, respectively. Then draw line *CD* perpendicular to *XX*, and equivalent to the radius of the largest new driven pulley to the same scale, or (12 + 4) ÷ 2 = 8 in. With 1.118 × center distance between pulleys, or 1.118 × 36 = 40.248, say $40\frac{1}{4}$ in. to the same scale as radius and *D* as center intersect *AB* at *E*, and with *E* as center draw arc *FDG*. Erecting perpendiculars on *XX* at *L* and *H*, the distances *LK* and *HJ* represent to the same scale the radii of the other two steps of the driven cone pulley, $6\frac{1}{16}$ and $5\frac{7}{32}$ in. in this case. The diameters are then 16, $13\frac{3}{8}$, and $10\frac{7}{16}$ in., respectively.

The constant 1.118 is the ratio of the radius of the arc to the center distance between the cone pulleys in Dr. Burmester's graphical method. From the above it is seen that Dr. Burmester's method is more easily applied.

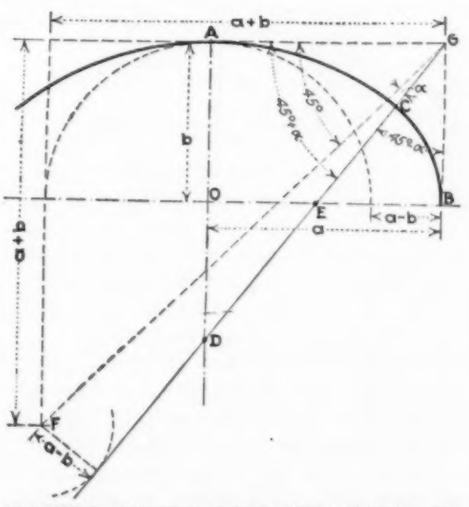
Calculating the Radii of an Ellipse

BY EDWARD HELLER

Most engineering handbooks give a method for the construction of an ellipse by two radii which gives a very close approximation of the figure, as shown by the accompanying sketch in which *a* is the semi-major axis and *b* the semi-minor axis. Lay off *a* + *b* horizontally and vertically as shown. From *F* describe an arc with radius *a*-*b*. Draw *GD* tangent to this arc and the intersections *D* and *E* are centers for radii *DA* and *EB* respectively and the point of junction *G* is on the ellipse. Now, this method becomes inconvenient when the ellipse is very large, or on the other hand, when it is very small and is to be laid out on the job itself, it is not very accurate. To overcome this difficulty I worked out the radii mathematically and I can tell at once what the lengths of the radii *DA* and *EB* will be.

First of all it is necessary to obtain the angle α. This is equal to

$\text{Sin}^{-1}\ \dfrac{a-b}{\sqrt{2}\,(a+b)}$; then $AD = a \tan (45° + \alpha)$ and $EB = b \tan (45° - \alpha)$.



GRAPHIC CONSTRUCTION OF AN ELLIPSE

IN THIS ISSUE

IN ALL our efforts to secure economy we must not overlook the foundry, for it is there that economy begins. The first article is by William H. Barry on the subject, "Elevated, Midway and Subway Gating." He advocates the use of three-part flasks on two-part work to increase production, which may appear at first to be a rather uncertain scheme, but one with which you will have more sympathy after you have finished reading the article.

There is an unusual treat this week in Tool Engineering, as it comprises seven pages, beginning with 211. It continues the subject of milling fixture design, taking up in particular the design and operation of indexing fixtures, semi-automatic and automatic indexing devices, the use of twin fixtures, and fixtures for continuous milling. The seventeen line cuts illustrate many types of fixtures that embody the principles discussed by the authors. You will be glad to know that many other readers are just as much interested in this series as you are and that some who failed to start in with the first installment have been making efforts to secure back numbers so that they may join the procession. While it is too late in most cases to secure the back numbers it is not too late to take up the series, which will run on, one installment per issue, for many months to come.

Colvin has taken enough time from his automotive articles to write several on railroad work. "Tools for Boring and Turning Locomotive Tires," page 218, furnishes data on sizes, angles of clearance, and rake of the tools together with the speeds and feeds used by seventeen of the leading American railroads. In an effort to secure some definite knowledge of present practice in tire boring and turning Mr. Colvin sent questionnaires to the leading railroads. The article referred to has been written with the results from these inquiries as a basis.

A special correspondent has supplied, page 220, an article called "Starting Right on the Gage Question." It has to do with the fundamentals and definitions adopted by the committee on plain gages for engineering work, of the A. S. M. E. Standard nomenclature for gages and gage fixtures is given, as are definitions of various types of gages and notes on their use. All of us no doubt recognize the desirability of standardizing nomenclature, but we have up to date accomplished little in that direction. It is to be hoped that all gage users will follow the work of the A. S. M. E. committee and will give their assistance toward determining standards whenever possible.

Mr. DeLeeuw takes up in Metal Cutting Tools the use of liquids when cutting metal, showing when liquid should be used for lubrication, for cooling and for washing out chips. The use of liquid has been common for some years, yet we are forced to believe that many users do not have a complete understanding as to why a liquid should be used and what kind of liquid should be used under given conditions. After you have studied this chapter you will have added something important to your production knowledge. Page 222.

When everything is going well and we are able to do a good day's work we are prone to think little of the human body. W. J. Matherly, page 226, reminds us once again that proper care of the human machine is as necessary as is care for machines of metal. His dissertation is not long, but it serves to bring out some of the things that we know, yet will insist upon forgetting.

The comparison of doing work on special machines and on standard equipment is continued this week in the third of the articles by Col. Jenks and Mr. Christopherson. Planing, milling, boring and turning operations are taken up.

We regret that we have recently lost one of our old stand-by contributors, E. A. Suverkrop, better known to some as E. A. Dixie, and familiarly known at the *American Machinist* office and among some of the plants as "Suver." Mr. Suverkrop died recently after a short illness. We still have one or two of his articles to be published. There is a brief story of his life in our news section.

Some of our articles are necessarily short, which is not an indication that they are lacking in quality. We call attention to "Foreign Buyers and the U. S. Dollar" page 233 and "Ethics and the Machine Shop" page 234. The first discusses depreciated currency and paper money. It contains some advice that exporters will do well to appropriate. The other is a discussion by John S. Watts on the efficiency of labor.

Coming Features

Our next issue will be devoted chiefly to series articles, among them Tool Engineering, Machining the Wrigley Automobile Transmission Gear, The Organization and Management of the Small Shop, Modern Production Methods and Incentive or Production Basis of Wage Payment.

We are glad to announce at this time that on about the twenty-fifth of August, or the first of September, probably the former, we shall introduce a new series. It will deal with economics, a subject that is now demanding more attention from business than any other. There will be about ten installments, all short and to the point, and sufficiently elementary to be generally understood.

EDITORIALS

The Passing of Rule-of-Thumb Methods

MANKIND, especially the variety that flourishes in these United States, is prone to be satisfied with methods that are almost good enough provided they produce results that will pass inspection. The enlightened Westerner smiles condescendingly at the Oriental who is content to do things as his grandfather did, but in some respects he is but little better than the man he pities.

Take for example the art of turning metal. What real advances have been made in the actual method of separating the chip from the work in the last generation? We shall not carry this line of thought further as to do so would be to steal some of Mr. DeLeeuw's thunder. The illustration is but one of many that might be cited.

The machine shop owner or manager who employed a trained scientist to solve his more intricate problems twenty or even ten years ago would have been considered well on the way to his second childhood. It just wasn't done.

But today the visitor in a thoroughly modern plant where fine machinery is manufactured cannot but be struck with the contributions of science to the excellence of the product. Not that the scientist does not make mistakes—he does, for he is only human, but he brings to his task a mind especially trained for the work in hand and a knowledge that combines the experience of many men.

This attitude of management toward expert scientific advice and ability is one of the most encouraging factors in the outlook for American machinery manufacture. It means that every possible means is being employed to reduce manufacturing costs and that we may hope to compete with European products without lowering the living standards of our workmen.

The respect for scientific education has been increasingly evident at recent meetings of some of the big engineering societies, notably the Automotive Engineers. A few years ago it was sufficient to build an automobile that would run without an undue amount of trouble and expense, whether the builder knew much about what actually went on inside the cylinder or not. Gasoline was cheap and the buying public did not know enough to be very critical of engineering inefficiencies. It may have been the threatened shortage of fuel and consequent price rise that did it, but anyhow there has recently been keen interest in what happens to the fuel charge drawn into the combustion chamber, with a view to improving the mechanism so as to eliminate some of the seventy-five per cent or more of waste that now goes on. We may not get tangible results at once but there is a rumor of a forty-mile-per-gallon car developed as a result of this research work, which is approaching a marketable stage.

Not every manufacturer can afford scientific advice, the real thing comes high, but he can at least take advantage of the information that is available to all and turn it to his own advantage, rather than to look askance at something his father never heard of.

The Right Price

SOME of the automobile builders are showing indications of buying new machine equipment while others are releasing orders which have been held up for delivery. But the question of price is being very carefully considered.

One large buyer is requesting that the machine builders furnish a statement of the price of the machine in 1914, in 1918 and in 1921. This is for comparison as to increase and the reduction from peak prices. The automobile builder then compares the prices of the machines with those of his own product. If the reduction has been in proportion to his own, no further questions are asked. If not, he passes to other machines which have come nearer to his own percentage of reduction.

This is much fairer than the usual demand for reductions regardless of the advances made. It gives the machine builder who advanced his prices only in accord with increased costs a good chance for getting the orders he deserves. Those who demand a heavy horizontal reduction are unfair to the machine builders who did not take advantage of the necessities of the situation.

The unfortunate fact is that many prices were too low in 1914 to allow a proper standard of shop equipment, of shop conveniences and of wages. We should never go back to that condition because it was subnormal or below standard. But we must all adjust ourselves to a lower rate of profits than was made possible by the demands of war. The attempt to maintain the war standard cannot fail to delay the return of normal business.

Have Machine Tool Builders Given the Public What It Wants?

WHILE the report of the American Engineering Council committee on the elimination of waste in industry is not by any means the engineering work that we had expected, the general conclusions reached are of value.

Worthy of comment is an opinion that the main cause of waste or inefficiency in the machine-tool business is "the failure of machine tool builders to give the public what it wants."

The machine-tool builders who, for many years gave in, against their better judgment, to customers' whims and caprices instead of standardizing and sticking to it will find it hard to agree with the statement. They will remember the number of "specials" that their shop cards carried and how costly these same specials became before they were finally tucked away in a freight car.

There is another way to look at it: what the public wants is machine tools that will give production—and it is getting them. Users of machine tools have sometimes shown the way to important improvements, but as a rule the builders themselves have taken the big steps in development.

Shop Equipment News

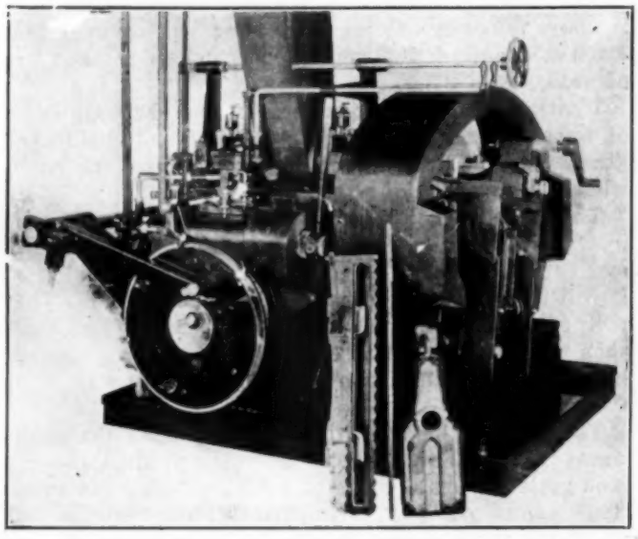
Osterhom Automatic Surface Grinding Machine

The illustration shows an automatic surface grinding machine recently built by William Osterhom, consulting engineer, 2301 N. Knox Avenue, Chicago, Ill. The machine is intended for the rapid and economical surfacing of parts up to 12 x 40 in. made in large quantities. One of the pieces of work in front of the machine is a radiator top for a motor truck, and the other a small drill press base about 20 x 10 in. in size. The chucking time is said to be 13 sec., and the actual grinding time 45 sec., about $\frac{1}{32}$ in. of metal being removed.

The machine is fully automatic, with the exception of locating the work and locking it in the fixture, which is mounted on a table pivoted about a swinging arm and moved across the surface of the abrasive wheel by means of a cam. Upon the completion of the cycle of the cam, the fixture is tilted back 45 deg. away from the wheel, allowing the operator to remove the work. The illustration shows the fixture in the grinding position, with the wheel dresser in place. Provision is made for varying the length of the stroke of the swinging arm from 2 to 24 in., and a change-gear box allows for varying the time of the cycle from 10 sec. to 2 min., to suit the work.

The water is automatically turned on and off with the opening and closing of the tilting table. A rotary pump supplies the coolant through the center of the spindle; and if delicate steel parts, such as edged tools, are to be faced, water is also supplied through the fixture.

The feed of the wheel is automatically controlled by a cam shown on the side of the machine, feeding the wheel gently forward onto the work during the grinding operation. The action of starting the grinding after placing the work in position is accomplished by pulling the handle on the top of the machine, which throws the belt on the tight pulley behind an arresting lever. The sheer drop on the cam releases the arrest lever, and also raises the work to the grinding position. A series of steps on the cam communicates the rotary action to a shaft to drive the wheel housing forward a preconceived distance against the work. A quick return of the lever to its original starting point traps the shifter arrest lever, unlocks the tilting work table and stops the action of the machine. An emergency stop is also provided.



OSTERHOM AUTOMATIC SURFACE GRINDING MACHINE

Wear of the wheel, as well as the proper placing of the wheel housing in relation to the work surface, is taken care of by means of a graduated handwheel. Another lever adjacent to the change-gear box allows the operator to stop the rotation of the cam, but gives free swinging of the work arm, as while dressing the wheel. The feed lever is cushioned so that in heavy grinding of irregular castings, the wheel has an opportunity to adjust itself, the cushioning spring taking the shocks and allowing the wheel to cut itself free. The entire working mechanism is supplied with positive oiling devices. The spindle is 42 in. long and 4 in. in diameter, with forced lubrication.

The machine can be equipped with automatic magazine feed. In this case, two magazines are used, one for receiving and one for delivery. The magazines control the operation of the machine as long as they are properly attended to. If the receiving magazine gets clogged up, the machine will stop, as it will, also, if the raw material magazine is emptied up to a certain point. This method of grinding is adaptable to such work as the facing of thin, hardened pieces of steel up to 6 x 6 in., thrust washers, and anything that can be stacked and magazined properly. The plain grinding machine is recommended by the maker on such grinding as manifolds and housings where a 2-minute operating cycle is used, one operator handling four machines.

A cylinder wheel, 20 in. in diameter, 8 in. thick and having a 10-in. hole, is used. The weight of the machine is 7,800 lb. Twenty hp. is required when operating at the maximum. The floor space is 72 x 84 inches.

Baily Electric Sheet-Heating Furnace

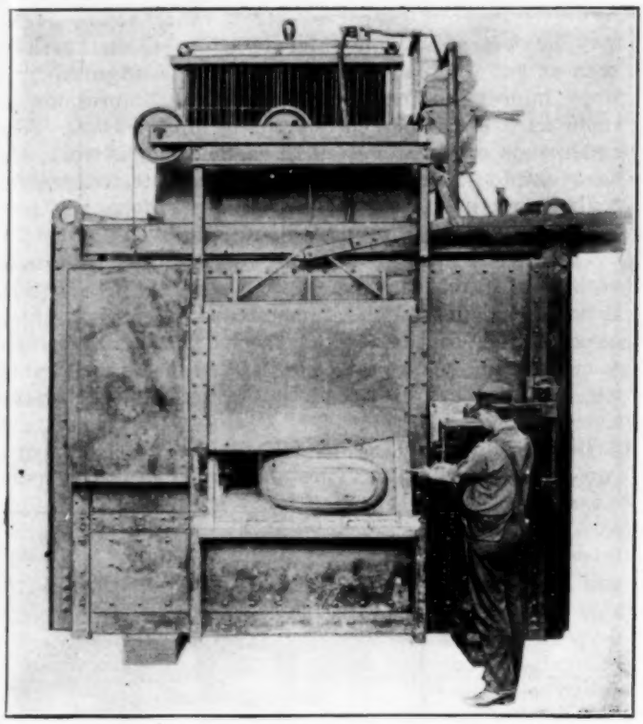
The illustration shows a resistance-type electric furnace intended for use in the heating of sheet-metal when forming parts of automobile bodies and fenders. It is made by the Electric Furnace Co., Alliance, Ohio, the one illustrated being installed in the plant of the Mullins Body Corporation, Salem, Ohio.

Since a large part of the pressing or drawing to shape is performed cold and only one or two hot runs are required for perhaps six or seven cold operations on the press, the furnace is portable, being handled by a crane and taken from place to place as the work requires, so that it need not be idle while one batch of material is receiving its cold runs. Four eye-bar connections are provided at the top, one at each corner, for hooking on the crane chains. The transformer and control equipment are located on the top of the furnace.

The furnace is rated at 100 kw. in electrical capacity, and has a hearth 3 ft. 4 in. wide by 6 ft. 5 in. long, with a door opening 3 ft. 4 in. wide by 2 ft. 2 in. high. It has a capacity for heating 750 lb. of material to

1,800 deg. F. per hour. In plants where a crane is not available for moving the furnace, the equipment can be mounted on a car which may be moved on a track parallel to the battery of presses.

One of the features of the equipment is claimed to



BAILY ELECTRIC SHEET-HEATING FURNACE

be the uniformity of temperature obtained on the sheets, largely because the doors need not be opened frequently as in fuel-fired equipment. Scaling is said to be reduced to an almost negligible item, making very much smoother sheets than is possible in fuel-fired practice, and saving labor in finishing them.

Alfred Herbert Power-Operated Hardness-Testing Machine

The hardness-testing machine shown in the illustration has recently been placed on the market by Alfred Herbert, Ltd., Coventry, England, and 50 Church Street, New York, N. Y. The machine operates on the Brinell principle, using a 10-mm. ball and employing the standard pressures of 500 or 3,000 kg., as required by the material being tested. The chief features of the machine are power operation and automatic application of the pressure.

It is claimed that the time required to apply the load, the duration of the load, and the time taken to remove the load are uniform for all tests and do not depend on the operator or on his physical effort. The operation of the machine by power enables the attendant to make tests continuously without fatigue and without chance of error it is stated. The machine can thus be considered as belonging to the class of workshop production machine intended for high output, as well as to the class of laboratory appliances.

Apart from the main frame, which carries all the mechanism, the machine may be said to consist of two elements, a weighing element and a straining element. The ball through which the pressure is applied to the specimen is carried by the lower end of a vertically moving plunger, the weight of which is neutralized by a light spring. This plunger moves upwards a small amount when the specimen to be tested is raised into contact with the ball, the pressure between the specimen and the ball being weighed by a pair of compound levers and a weight, which latter becomes poised when the full pressure is reached. The fulcrum of the first lever consists of a pair of ball-bearings, and the point of application of the pressure is a hard steel roller between two hard steel seatings. The other lever takes the shape of a pair of pulleys or sheaves with a pinion keyed between them and engaging with the teeth on the first lever.

A wire cord passes around the two sheaves and also around a third sheave attached to a weight located inside the column. An opening is provided in the column for removing and changing the weights. The first-mentioned lever is provided with a sliding weight for calibrating the machine for each load in the first instance. An indicator situated at the front of the machine shows when the weight is poised, and the full load on the specimen.

The object to be tested is placed upon a flat anvil or pressure plate resting on a spherical seat on the top of a vertical screw, which can be elevated by a hand-wheel to bring the work into contact with the ball. The screw itself occupies an axial position in a vertically moving cylindrical ram, the small upward movement of which forces the work against the ball and applies the pressure, which is regulated and resisted by the poised weight of the weighing element.

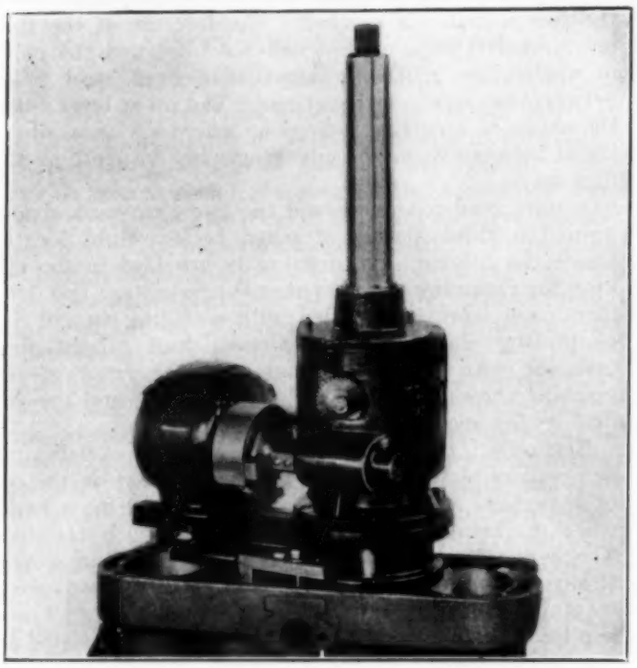
The lower end of the ram carries a roller resting on a cam, which makes a single rotation for each test. The cam is formed so as to apply the load gradually, to maintain it for the predetermined period and then to remove it. It is rotated by a wormwheel and worm driven by spiral gears from a single driving pulley.

HERBERT POWER-OPERATED TESTING MACHINE

Specifications: Diameter of ball, 10 mm. Pressures provided, 500 and 3,000 kg. Maximum height between ball and pressure plate, 10½ in. Distance from center of ball to frame, 9¼ in. Diameter of pulley, 9 in. Width of belt, 1¾ in. Speed of pulley, 500 r.p.m. Floor space, 2 ft. 6 in. x 3 ft. 6 in. Weight: net, 1,680 lb.; gross, 2,200 lb.

Van Dresser Electric-Driven Cylinder-Reboring Tool

On page 924, Vol. 54, of the *American Machinist* appears a description of the Van Dresser cylinder-reboring tool made by the International Purchasing and



VAN DRESSER ELECTRIC-DRIVEN REBORING TOOL

Engineering Co., Inc., 506 McKerchey Bldg., Detroit, Mich. The device was intended for drive by hand or by means of a drill press; but it has now been fitted with the individual motor drive shown in the illustration.

The motor is mounted as a part of the tool, no flexible shaft being employed. A friction clutch is incorporated between the motor and the tool, so that slippage is possible in the event that the cutter head becomes wedged, thus protecting the motor. The final drive is through a hardened worm and bronze worm wheel running in oil. Without making any disconnections, it is stated, the tool can be operated by hand or by the spindle of a drill press. The tool has a range of from 2¾ to 5⅛ in.

Some of the features of the tool which the maker emphasizes are the solid hardened and ground feed bar that has no threads, the heavy bearings 10¼ in. long, the tapered arrangement for fitting the boring head in the feed bar, the six high-speed-steel blades, the quick-return feature that allows the boring head to be brought instantly to the starting point, and the elimination of split guide rings.

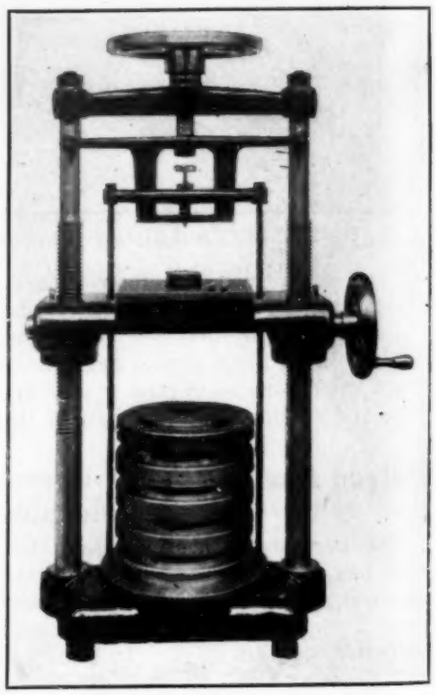
Alfred Herbert Small-Ball Hardness-Testing Machine

The hardness-testing machine shown in the illustration has recently been placed on the market by Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y. The machine is a development of the Brinell method of determining hardness, the difference being not in principle but in the use of very small balls with correspondingly small loads. It is intended for determining accurately the hardness of thin specimens, such as the walls of small-arm cartridge cases, and of finished articles which cannot be subjected to the pressure of ordinary hardness-testing machines, either because of their small size or because of the injury caused by making a comparatively large impression.

The maker claims that the hardness of material 0.01 in. or even less in thickness may be determined accurately. Thin-walled tubes and other hollow forms may be tested without internal support, and articles such as cutlery blades which would be disfigured by a large impression may be tested by an impression so small as to be imperceptible to the unaided eye. The machine is of use for testing case-hardened work, the hard skin of which is too thin to be tested by the ordinary method, and the hardness of a cutting tool may be determined close to the cutting edge.

The load is applied by dead weight. The balls used are 1 and 2 mm. in diameter with loads up to 50 kg., although balls of 5-mm. diameter are supplied for testing extremely soft material. The hardness numbers are calculated in the same way as in the ordinary Brinell test, the load being divided by the area of the impression.

The machine consists of a baseplate which supports two threaded columns. The table for holding the specimens to be tested is carried by these columns, and is adjustable up and down by a handwheel, so as to set the table at the required height. The baseplate is furnished with leveling screws. At the top of the column is mounted the crosshead, in the center of which is a fine-pitch non-rotating screw, which can be raised and lowered by a handwheel provided with ball thrust bearing. The lower end of the screw carries a suspension stirrup, prevented from rotating by arms bearing against the columns, and from this suspension stirrup is hung a loading stirrup, to the upper portion of which is attached the ball-holder, while the lower portion carries the weights.



HERBERT SMALL-BALL TESTING MACHINE

The ball is attached to the ball-holder by an india-rubber solution, so as to render the changing of balls an easy matter. The table can be set at the required height, and the work then placed in position under the ball, a supporting block or fixture being used if desired. The upper handwheel is then turned until the ball rests upon the specimen, the loading stirrup being free and disconnected from the suspension stirrup, so that the whole weight is upon the specimen. The upper handwheel is then turned back to take the weight off the

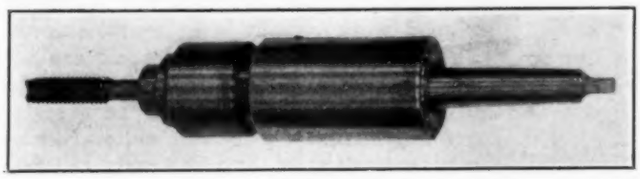
work, which can be removed and the diameter of the impression measured. Each machine is supplied with three ball-holders, a set of graduated weights totalling 50 kg., and a hardened steel disk or anvil for supporting small articles.

Specifications: Work table: width, 7½ in.; depth, 6 in. Height from work table to ball using maximum weight of 50 kg., 8 in. Overall dimensions: width, 21½ in.; depth, 12½ in.; height, 36 in. Weight: net, 210 lb.; shipping, 280 lb. Shipping box, 19 cu.ft.

Apex Safety Friction-Slip Tap Holder

The Apex Machine Co., Dayton, Ohio, has recently placed on the market the friction-slip tap holder shown in the accompanying illustration. The principal feature of the device consists of the arrangement which permits of slippage within the holder itself, in case the tap becomes wedged or strikes the bottom of the hole. It is thus particularly adaptable to use in tapping blind holes, both in single-spindle and multiple-spindle drilling and tapping machines. Because of the small outside diameter of the device, use on multiple-spindle machines is quite easy. The tap holder will operate in any position, whether horizontal, vertical or inverted.

The holder is made in two sizes. Type A has a body 1¼ in. in diameter and 3 in. long, and will tap all sizes of holes up to and including ½ in. Type B has a body 1¾ in. in diameter and 4 in. long, and will tap holes from ¼ to ¾ in. in diameter. The type A holder has a No. 1 Morse taper shank for holding it in the machine spindle, and the type B has a No. 2.



APEX SAFETY TAP HOLDER

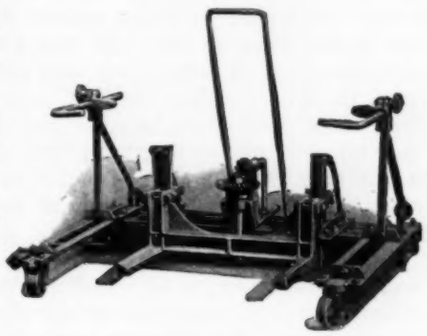
The holders may be fitted with screw jaw chucks or with quick-change collets for the holding of standard hand taps. In the collet the tap is driven by the square and held in position by means of two dogs mounted in a slot at the end of the collet, with the ends protruding into the flutes of the tap. The collet may be inserted or removed by raising the sleeve.

A very large amount of friction surface is said to be provided in the holder, by the use of a number of alternate steel and fiber washers, so that it is easy to maintain the adjustment of the holder and so that long life is obtained. The amount of friction may be quickly adjusted when changing from one size of tap to another. The holder embodies a $\frac{3}{16}$-in. vertical float movement, to allow for a slight variation in the lead of the tap. There is also a lateral float of $\frac{1}{32}$ inch.

Manley Truck-Wheel Dolly

In the accompanying illustration is shown a device recently brought out by the Manley Manufacturing Co., York, Pa., for handling automobile truck wheels in a repair plant. This dolly is intended both for conveying the truck wheels and for raising or lowering them. It is mounted on ball-bearing casters, and provided with a handle by which it can be manipulated about the shop.

The truck wheel is carried on two projecting forks, seen at the front of the illustration, the forks being far enough apart to enable them to be put under a wheel standing on the floor. The forks have a vertical movement of 5 in., being operated by a crank, so that the height of the wheel can be easily varied. The elevating screw runs on a ball thrust bearing. The device is particularly adapted to removing wheels from the spindle of the axle, or replacing them. Owing to the fact that the dolly is very low, it does not strike the fenders of the truck. The top of the wheel is not obstructed, so that a chain attached to a crane may be easily used for lifting the wheel into a tire press. An unobstructed view may be obtained inside the hub. Two arms are provided for holding the truck wheel from falling, these guards being needed chiefly when pneumatic-tired wheels are being handled. The position of the guards are adjustable.

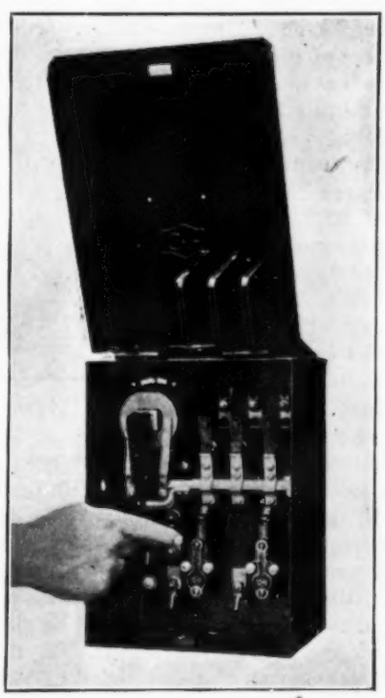


MANLEY TRUCK-WHEEL DOLLY

The dolly is made principally of structural steel. It is 24 in. in height, 44 in. in width, and has a depth of 37 in. The weight is 210 lb. It is claimed that the device can hold wheels up to 48 in. in diameter and having a 16-in. face width, being capable of supporting a load of one ton. The dolly is said to permit of the handling with ease and safety of the largest truck wheels by one man.

Cutler-Hammer Automatic Starter for Squirrel-Cage Motors

The accompanying illustration shows the No. 9604 automatic starter developed by the Cutler-Hammer Manufacturing Co. for small squirrel-cage motors of 7½ hp. or less. The starter is said to allow a large starting current for several seconds, but at the same time to give positive protection against burning-out and to prevent harmful overloading of the motor. The two mercury overload relays mounted below the contact fingers are intended to eliminate fuse troubles, while allowing overloads as high as 25 per cent for a limited period. The overload relay consists of a glass tube carrying a mercury column, which forms a part of the pilot circuit of the magnetic switch coil. A portion of this column is surrounded by a heating coil, or thermal element, in



C-H AUTOMATIC STARTER FOR SQUIRREL-CAGE MOTORS

series with the motor circuit and heated in the same proportion as the motor windings. Excessive current passing for too long a period heats the coil, causing the mercury to boil and the vapor to pass up into the chamber at the top of the tube. This action breaks the liquid mercury column and opens the circuit to the magnet coil. As this coil is de-energized, the contact fingers drop away and disconnect the motor from the line. After such an interruption, the mercury cools down and becomes liquid again, dropping back into the tube so that the pilot circuit to the magnet coil is soon complete. The motor will not start, however, until the control button is depressed after the relays have reset.

As the functioning of these overload relays depends upon the temperature at which mercury will boil, it is evident that the current required to operate the relay increases with the decrease in the temperature of the surrounding air. If the motor and the starter are installed in a cool location, the relay permits a greater starting current or a higher overload than if the temperature of the surrounding air were higher. The push-button station which is supplied can be installed in any position that is most convenient for the operator. It is stated that considerable time is saved by using the automatic starter in place of a manually operated starter, the amount depending, of course, upon the frequency with which the motor is started and stopped.

Time Study Watch

The time study watch illustrated herewith has recently been placed on the market by the Stein & Ellbogen Co., 31 North State St., Chicago, Ill.

The double hands permit the taking of two closely related operations at the same time or a comparative observation of two workmen or machines. In case of an interruption, the total time and the waste time entailed can be shown in figures of production as well as in decimals of a minute, thus simplifying computation. On the dial there are placed at intervals of 0.02 min. figures showing the rate of hourly production. Thus, if an operation started at zero and lasted 0.84 min. the dial would show that the operation was being performed at the rate of 71.4 pieces or operations an hour.

TIME STUDY WATCH

Both hands are started by pushing down the crown. By pushing the button at the left of the crown, the under hand is stopped while the upper one is allowed to travel.

In the case of an observation of two different operations, the under hand would be stopped at the completion of one of the operations. In the case of timing two workmen on the same kind of work, stopping one hand would show the time taken by one workman to complete his task. In the first case stopping the upper hand would show the time consumed by the operation taking the longer time, and in the case of timing two workmen it would show the time taken by the slower.

Is Superficial Training Satisfactory?—Discussion

BY A. W. FORBES

W. K. Campbell has an article on page 1,067, Vol. 54, of *American Machinist*, entitled "Is Superficial Training Satisfactory?" I think most of us will agree that it is not, but how are we to get any other kind?

Assume that a boy wants to start work at the age of 15 or 16. This year his choice of work is quite limited, but a year ago, and a year hence, he had or will have a choice as broad as could be desired. He could learn to run a machine on one operation and get man's pay in a very short time. He could go to one of the shops where the old-style apprentice training was in effect. He could go to a trade school. The first choice will always produce the largest immediate returns in the pay envelope, and who is to prevent the boy from choosing it? Our child labor laws also encourage this course, by making so many prohibitions, that some are bound to conflict with any employer that tries to give all-round training. Give the boy just one thing to do and the chances are that it will not conflict with any law.

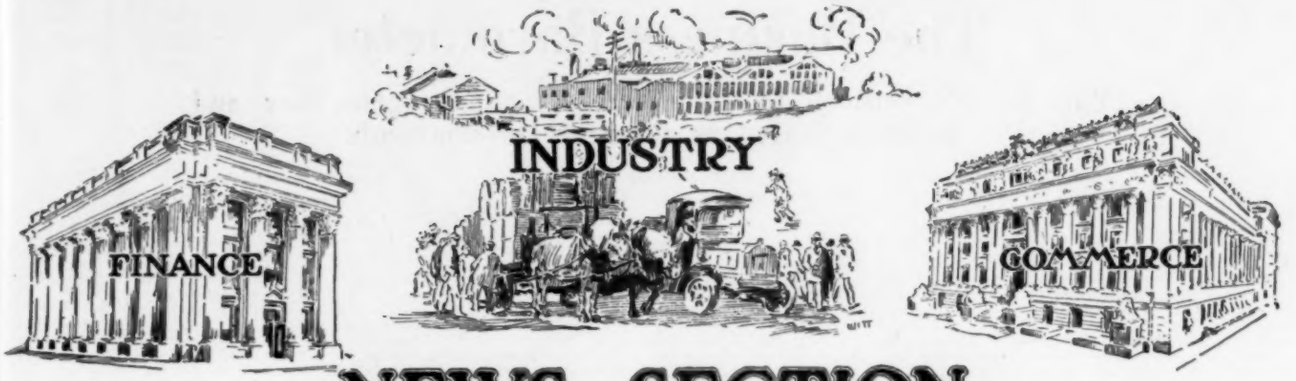
But then I am not sure that it is a bad thing to become a specialist on one machine. All the machines in a machine shop are much alike so that a real specialist on one can do good work on any with practice for a day or two. The trouble is that most of them are not specialists, except in the sense that this term may be used as a limit of knowledge rather than as a statement of it. Give a specialist a piece of stellite after he has been using high-speed steel, or vice versa, and few of them will know enough about their work to make good with the other materials. In examining applicants for a job, I often ask what material they would use for the cutting tools, and the so-called specialist usually says that he uses what is given him by the management. Certainly he has no right to the name of specialist.

ADVANTAGE OF VARIETY IN WORK

Variety in work has an advantage, but I find that in my shop the boys get too much variety for their own good. The work is such that I can seldom give them more than 100 pieces of a kind, and the exceptions where the quantity is larger are not the jobs that require much time or thought. The boys get acquainted with all the machines so that after a few years they can do most any kind of job within our range of work, but they do not stay at one thing long enough to get the fundamental theories of the action of a tool, or long enough to see that the tool might cut 25 per cent faster if placed in the toolpost at a slightly different angle.

The trade schools in general carry this fault one step further, and give such a great variety of work that it seems as though the boys lost most of the value of the practice.

I should like to see some shop make a real effort to produce specialists who really know the job. But this is probably impossible. Before they had advanced very far they would either think they knew it all and stop learning, or they would be taken into the engineering department.



NEWS SECTION

O. K. Davis to Represent U. S. at Postal Congress

The appointment of O. K. Davis, chairman of the advisory committee on foreign mails, as chief representative of the United States Government at the Pan American Postal Congress, to be held in Buenos Aires, Argentina, marks a new step forward in the development of closer relations between the Government at Washington and the business men of the country.

Mr. Davis is chairman of the advisory committee on foreign mails, an organization of American business men interested in the use of development of postal service to all parts of the world. During the last few years, this advisory committee has been working in close co-operation with the Post Office Department and has been able to initiate and secure many extensions and improvements in our foreign mails. Mr. Davis is also secretary of the National Foreign Trade Council, an association that stands for "greater prosperity through foreign trade."

The selection of Dr. Davis is a matter of great significance to our foreign trade," said Postmaster General Hayes in announcing the appointment. "Mr. Davis goes as the representative of the great industrial organizations of the country to establish foreign money order policies, postage rules, and other matters vitally affecting our trade with Pan America."

The Congress, which meets in Buenos Aires in August, will consider matters affecting letter mail and printed matter. Among the suggestions given the delegation by the business men of the United States, through the medium of the advisory committee on foreign mails, are the following, which are considered by many to be the most important.

Extension of domestic rates on letters and printed matter to all Pan-American Countries.

Removal of taxes on printed matter entering a country by mail.

Elimination of consular invoices on parcel post shipments, especially on those of less than $100 value.

Standardization of customs declarations and customs procedure in simplified form throughout all Latin America.

Extension of registered mail service to all Pan-American countries, and increase in indemnity obtainable to at least $50.

Removal of prohibitions on the import of articles by parcel post, and agreement to admit any article not barred by the mails of the country of origin.

Increase in weight limits of parcel post to 50 lb. and in measurement to 7 ft. combined length and girth.

Extension of direct money order service to all Latin America, and eventual establishment of parcel post C. O. D. service.

Two Firms' Equipment Being Sold

W. H. Savage, Fitchburg, Mass., is selling off all the machinery and equipment of the Standard Plunger Elevator Co. and the Powell Machine Co., of Worcester, Mass., at private liquidation.

This equipment includes some six hundred machine tools, drawings, patterns, tools, jigs and fixtures, and parts in process of Powell planer, which is to be sold as a going business.

Walter H. Rastall to Head New Division of Department of Commerce

Problems connected with the marketing of American heavy machinery throughout the world are to receive the special attention of the new heavy machinery industrial division of the Department of Commerce. The Secretary of Commerce announced July 28 that Walter H. Rastall, of Dayton, Ohio, has been selected to take charge of the division.

The situation in regard to establishing markets abroad for machinery is unusually attractive at this time, state officials of

WALTER H. RASTALL

the department, owing to the strong nationalistic spirit which the experiences of the war has created in many countries. This spirit is manifesting itself particularly in Latin America and the Far East, where the business men have learned the dangers of complete dependence on outside sources for essential industrial supplies. As a result, departmental officials believe that the potential market for American heavy machinery is most promising, and the hope is expressed that the work of this new division may be instrumental in the sale of much American equipment of this character in industrializing the less developed countries of the world.

Mr. Rastall is a graduate of Cornell University and a mechanical engineer. He has had much practical experience in marketing machinery both in this country and abroad. A short time ago he returned to the United States from an investigation of markets for American machinery in the Far East. In his new position he will keep in close touch with the centers of machinery production in this country and by personal contact endeavor to afford that industry and trade maximum service from an informational and marketing standpoint.

Mr. Rastall was born in Burlingame, Kan., forty-one years ago. His primary education, however, was obtained in the public schools of Chicago. He also attended the Manual Training School maintained by that city. He then entered Hebron Academy at Hebron, Maine, and later took the three-year civil engineering course, with electrical electives, at the University of Maine. He then took two years of mechanical engineering with electrical electives at Cornell University, where he earned the degree of mechanical engineer.

In his private practice, Mr. Rastall has served as a marine draftsman at the Bath Iron Works, Bath, Me., and at the Eastern Shipbuilding Co., at New London, Conn. Later he was chief draftsman of the Latrobe Steel & Coupler Co., at Melrose Park, Ill.

From 1904 to 1911, inclusive, Mr. Rastall was stationed at Kobe, Japan, as resident engineer for the American Trading Co. In that position he was responbile for the engineering and commercial features of the business involving the sale of American industrial machinery to Japanese buyers. Under his direction the volume of business done was increased from an insignificant amount to $500,000 annually. The company which he served acted as agents for some twenty of the leading American machinery manufacturers, including such equipment as mining machinery, pumping machinery, power plant equipment, gas engines, ice plants, waterworks, paper mills, cement-making machinery, railroad and ship yard supplies, and steam engines and boilers. Mr. Rastall installed the first mechanical filter plants used by municipalities in China. He also installed filter plants in Japan and Korea. One of the important pieces of work undertaken by Mr. Rastall during his stay in Japan was the delivery of 2,000 tons of sugar-making machinery at a point in Formosa. He directed the erection of a plant having a capacity of 500 tons of sugar cane daily.

From 1912 to 1917 Mr. Rastall engaged in engineering work in the United States. From 1913 to 1917 he was sales engineer for the Worthington Pump and Machinery Corporation. With the outbreak of the war he joined the staff of the Bureau of Aircraft Production and was given charge of the Dayton, Ohio, district. In 1918 he was borrowed from the Bureau of Aircraft Production by the Department of Commerce to investigate industrial machinery markets in the Far East. This survey, which was completed within recent weeks, involved visits by Mr. Rastall to practically every port in Asia from Karachi and Bombay to Yokohama, including Ceylon, the Dutch East Indies and the Philippines.

Tempering of Hardened Steels at Bureau of Standards

A very thorough investigation is under way in the metallurgical division of the Bureau of Standards dealing with the micro-changes which occur during the tempering of hardened steels. Some idea of the work involved in this investigation may be gained when it is remembered that it is necessary to take hardness measurements and make microscopic examination of all the specimens of each type of steel for each tempering treatment. Over 800 specimens are involved in the investigation and the time necessary for the mere polishing for examination is very considerable.

The results of the investigation are published from time to time for the benefit of American industries.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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That the Soviet government has agreed to release the Americans it held in prison in order to obtain relief for the famine stricken people of Russia is by far the most important news of the week. Politically it means that Communism has confessed failure and in its economic aspect it is no less auspicious, for through the door that has been opened from within the forces of western civilization will no doubt be able to make their way and ultimately effect the commercial and industrial regeneration of the hundred and seventy millions who compose the Russian population. In a recently published and very interesting book upon "The Economics of Communism" written by Leo Pasvolsky, editor of the *Russian Review*, the collapse of the Lenin regime is predicted upon the ground that "Communism is impossible without the application of compulsion in the economic life of the country; but economic production is impossible with the application of such compulsion."

It is of the highest significance that under the compulsion of events, the truth of this syllogism is being made evident to the Russian people for it argues the early re-establishment of a sane and orderly government that will foster and stimulate their economic development.

Second in importance to the news from Russia is the announcement that the Sinn Fein army in Ireland is being demobilized. This is construed as meaning that a solution of the Irish problem has been found and that another irritating sore in the world's body politic is healing. The stage is thus being cleared and set for the disarmament Congress to be held in November and if at that gathering a concordat that will insure peace shall be secured, a world wide revival of enterprise and activity will no doubt follow.

To rouse our business men from their unwarrented lethargy it would seem to be necessary that the facts which connote improvement should be marshalled with dramatic effect, for as we turn our eyes from overseas to a survey of the forty-eight states which comprise the Union, the view is far from discouraging though many refuse to be comforted and persist in a melancholic interpretation of the record as they call attention to the decline in copper and the poor demand for iron, steel and coal, which are almost the only unfavorable features in an otherwise normal outlook. But while it is true that July production of pig iron was only 864,555 tons, the lowest since 1903, it is also true that at each decline in the price of steel there is more buying and the *Iron Age* reports that the volume of orders is increasing although the railroads, who are the largest buyers of steel, are still waiting to get the $500,000,000 for which President Harding has encouraged them to hope before entering the market. Of copper it is said that the present offtake is twice the current output, although prices are lower because the large producers are wise in stimulating consumption by selling cheaply.

The prospect is that we shall go into the winter facing a shortage of both steel and copper, as a result of which belated buyers may have to pay dearly. The same statement applies to coal, for the predicament into which consumers are drifting through indifference or pessimism is alarming thoughtful students of the facts. At the present rate the indicated soft coal production for the year will be the smallest since 1911 and far below the consumption, even though there be no revival in the industrial demand.

But the admitted depression in these three mineral products is more than offset by cheerfulness that pervades most other markets. Bradstreets index number reflects an advance of 3.07 per cent in wholesale commodity prices during July, on top of a rise of 1.05 per cent in June.

The improvement is greatest in textiles, which have continued to harden during the week, reflecting the advance in the cotton market where a broad speculation is developing following the government's alarmingly low condition report and the sensational statement made with regard to the ravages of the boll weevil. Much higher prices are quite possible as it is doubtful whether the public or the trade yet appreciate what a crop that some think may not be over 8,000,000 bales would mean. It would be the smallest since 1895, since when the world's spindles and normal consumption have almost doubled.

Rise in Staples

Sugar, coffee, tea, hides and canned goods continue firm with an upward tendency, and even Irish and sweet potatoes are described as excited and higher. In the grain markets a curiously confident belief in higher prices seems to be gaining ground, though it has not yet found expression in higher prices for wheat.

In all these commodities the reversal of speculative sentiment probably reflects a subconscious appreciation of the gold inflation to which I have so often alluded. This influence is more directly apparent in the London price of silver, which has advanced to 38⅝d. per ounce from a low of 30⅜d. touched last March. Probably because it fluctuates more directly than commodities in inverse relation to the value of gold and is still the currency preferred by more than one half the world's population, many shrewd observers regard it as the most reliable indicator of commercial and financial conditions of which we have knowledge. At all events the record shows that an advance in silver generally coincides with an improvement in the world's trade and as gold piles up in the United States it seems unreasonable to expect a decline in the white metal.

At the risk of seeming academic I stress these somewhat recondite aspects of the situation, because gold imports for the first seven months of 1921 exceed $400,000,000 and the weekly statement of the Federal Reserve Banks shows a further gain of $21,000,000 in the total gold held. It is my firm conviction that this continued influx of the yellow metal must ultimately work a marked advance in the values that are measured in gold. Whether Europe is sending us her gold because she has to or with the deliberate purpose of so cheapening credit that she will be able to borrow freely here does not make much difference. The result will be the same and it is upon this assumption that my expectation of an early revival of speculation is based.

That it will be the policy of the Federal Reserve Board and bankers generally to restrain the speculative outbreak that impends may be taken for granted, but the opposition to this policy is growing and public opinion may compel its abandonment now that President Harding is boasting of the reduction in the rediscount rate as one of the things that his administration has done for business, and Ex-Comptroller Williams' testimony before the Agricultural Committee of Congress is attracting nation wide attention. The sensational character of Mr. Williams' statements and the effort that Governor Harding of the Federal Reserve Board made to answer them with his fists is in fact almost the only really exciting item in the domestic news of the week.

It is the abnormal that inspires the scare heads to which we became accustomed during the war and normalcy is now general rather than exceptional in American business. Making allowance for the decline in prices the volume of business is rather above last year, if bank clearings and department store sales for June are reliable indicators. The former are 15.6 per cent under 1920 and the latter as reported by the Federal Reserve Bank shows a decline of only 11 per cent, the percentage in both cases comparing with an average depreciation of 40 per cent in market values.

Money is in abundant supply at from 5½ to 6 per cent for the best commercial paper and the demand for high class bonds continues. The $300,000,000 treasury certificates offered at 5¼ to 5½ were three times oversubscribed and Liberty Bonds have been slowly rising.

The daily fluctuations in the prices of these Government securities are so small that the advance registered may not be generally appreciated. The prices of last Thursday compare as follows with the low record of 1920:

		Present Price	Low 1920
1st 3½s	1947	88.24	89.10
2nd 4¼s	1927–42	87.74	81.10
3rd 4¼s	1928	92.04	85.60
4th 4¼s	1933–38	87.80	82.00
5th 4¼s	1922–23	98.80	94.70

As money declines Liberty Bonds are almost certain to advance and there is every indication of lower interest rates. The stock market has been dull but steady. Price changes are not important or significant. The railroad stocks continue steady with a tendency toward higher prices which reflects the improvement in net earnings and the gradual betterment in the financial condition of the transportation industry.

The demand for lower freight and passenger rates is, however, becoming more insistent day by day and if the railway managers are wise they will heed it. Great dissatisfaction is expressed at the action of the Interstate Commerce Commission in refusing to allow Henry Ford to reduce rates on his railway more than 5 per cent each thirty days. It is recalled that an advance of about 30 per cent over night was permitted and shippers feel that it is a poor rule that won't work both ways.

Secretary Mellon is apparently trying to compel governmental economy by asking Congress to spend less or raise more revenue by advancing letter postage to three cents, putting a two-cent stamp tax on checks and a Federal license tax of $10 on automobiles. The probability is that appropriations will be reduced, for the Congressman that votes to increase taxes will probably lose his job in 1922.

Mr. Fordney's tariff bill seems to have been chloroformed in the Senate. Whether it will survive the capital operation to which it is there to be subjected is doubtful. There will not be much grief over its demise, for in its unpopularity it is unique.

The prevailing opinion is probably expressed by a friend who said that if Congress would readjust taxes, reduce railway rates and go home, business would boom. This is too much to hope for, but we may at least be thankful for a temporary respite from new legislation.

	End of Last Week	End of Previous Week	Last Week
Bank Clearings (Bradstreets) in thousands	$6,548,228	$5,620,478	$7,767,160
Business failures	319	390	128
Security prices, N. Y. Stock Exchange			
20 Industrials	69.50	68.18	84.06
20 Railroads	73.97	73.58	74.03
40 Bonds	78.27	77.76	74.18
Commodity prices			
Wheat, No. 1 spring	$1.62	$1.59	$2.97
Corn, No. 2 yellow	.76½	.78¾	1.71
Beef, good dressed steers	16.25	16.00	24.00
Pork, mess, bbl.	24.50	24.00	33.00
Sugar, refined	.06	.06	.21
Coffee, Rio No. 7	.07 7/16	.06¾	.10½
Cotton, middling	.1345	.1200	.3950
Print cloths	.04¼	.04¾	.13
Wool, domestic average	.4021	.3974	...
Silk, No. 1, Sinshiu	5.70	5.80	5.41
Rubber, crude, plan	.15	.13¾	.29½
Hides, pack, No. 1	.14	.14	.29
Iron, No. 2, Phila.	21.35	21.35	52.00
Steel billets	30.00	30.00	55.00

American Engineering Council's Report on Waste in the Metal Trades Industry

Some of the findings of the various investigators reporting to the committee on the elimination of waste in industry of the A. E. C. are now being disseminated. Among them is the report on waste in the metal trades industry, a summary of which follows:

Idle men and machinery are causing an annual loss of nearly a billion dollars a year in the metal trades industry. This estimate covers the value of labor only and does not include the value of materials that would be utilized if the productivity of labor were increased. The value of increased possible production in the United States even in normal times would, it is estimated, be over half a billion dollars.

The views of some of the managing executives in thirty-two of the plants visited, as to the main cause of waste or inefficiency were as follow:

"In eight plants the answer referred particularly to present business conditions and was to the effect that 'the most important cause is the uneven volume of business or the fluctuation in the demand for the product; lack of enough business to keep going at normal capacity.'

"In four plants the cause given concerned the railroad situation and the functioning of the Railroad Adjustment Board.

"In three plants the cause given was 'lack of standardization of design of products.'

"In two plants the cause given was 'labor turnover and strikes,' one executive saying that these had been caused by wartime conditions.

"In four plants the cause given was 'lack of planning'—the exact words used being 'lack of proper planning and routing;' one 'lack of correct planning and material control;' one 'unscientific planning and management,' and one 'lack of efficient planning and management methods.'

"In six plants the cause given was 'lack of co-operation between management and labor.'

"Other causes given in various plants were as follows:

'Lack of intensive study of methods;' 'cost control system needed;' 'daily cost reports needed;' 'lack of scientific management applied to all phases of the business;' 'inefficiency of labor and excessive overhead.'

"In other plants special causes in the machine tool business were given as follows:

"The failure of machine tool builders to supply what the public wants.

"Most of the metal trades shops are very small and require personal handling by the manager of such important problems as are handled by our system of production control.

"Insufficient capital to develop sales and to improve facilities.

"Purchasing in small quantities, by the small plants, which places them at a disadvantage as to favorable prices and as to transportation and handling expense."

The major cause of waste or non-production in the metal trades industry at the present time is the unemployment of available labor and equipment, due to general business conditions which affect all other industries.

The estimated waste in fifteen representative plants selected by the committee averages 28 per cent for them all and ranges from 8 per cent waste for the best plant to 56 per cent for the worst. The size of the plant, whether large, medium or small does not necessarily affect its efficiency, as some large plants as well as some small ones have a large waste factor.

The metal-making branch of the industry is not included in this survey—that is the branch which produces what are usually known as raw materials, plates, shapes, wire, piping, etc.

A comprehensive study and survey was made of fifteen representative plants, of various sizes and types, distributed through the states which lead in the industry. In addition to these detailed surveys or assays, a number of other plants were studied, and general information obtained through the co-operation of various metal trades associations.

The major causes of waste or non-production, applicable to normal times as well as to the present abnormal times, is attributed to instability of labor employment and inefficient management. Most of the plants surveyed gave very little thought to the instability of labor employment.

The proper relationship between management and labor, such as exists in the most productive plants investigated, is more than ever a controlling factor. The plants with the highest labor turnover (which reflects discontent) are in general the most wasteful of human effort; hence secure the smallest production per man hour. It is found further that generally the best relationship exists and the best understanding and least friction prevail in plants where the most thorough and scientific study of organization methods and standards have been made by the management in co-operation with the workers.

The careful planning of work; the providing and the moving of materials by means of effective and recognized methods of material control; comparison of output of departments and of individuals with fair standards of performance, fairly and scientifically determined; these are the practices of those concerns which have been most free from labor unrest, and where greatest mutual confidence and co-operation exist between employer and employed.

The provision by the management of proper facilities and conveniences for developing the latent productivity of the workers and the provision of fair incentives for those who make good, play a large part in eliminating waste in the best establishments.

It is shown by experience of the plants visited, as well as by general experience, that considerable improvement can be brought about by means of modern employment methods, which provide among other features for a close study of why men quit.

The average labor turnover for the year 1920, for the plants covered by these studies (wherever records were kept, which was the case in less than half of the plants), was 160 per cent, the percentage given in most cases being the ratio between the number of separations and the average number on the payroll. The highest turnover was 366 per cent.

There is a practical minimum to the labor turnover in a shop or factory, which cannot be excelled in special cases. There are separations that are unavoidable, due to deaths, marriages, etc., for which 60 per cent may be allowed which still leaves an avoidable or preventable turnover of say 100 per cent annually, in the metal trades industry. This of course can be done only by a most thorough understanding and co-operation of all concerned: management, labor and the public.

In this industry, then, with its 2,000,000 employees, with the average plant virtually renewing its entire working force, or filling each position, one-and-a-half times a year, we have 2,000,000 unnecessary separations, the equivalent of 2,000,000 workers annually separated and re-hired somewhere, and at what cost? Expert estimates of the cost of labor turnover vary from $50 to $250 per employee hired, trained and separated. An average figure of only $50 each applied to 2,000,000 employees means an average waste of $100,000,000 due to avoidable labor turnover, in this one industry.

Instability of labor employment resulting from strikes and lockouts has not been as serious in the metal trades industry as in some other industries, with the exception of the shipbuilding branch of this industry.

An open interchange of ideas and business results by managements both in this particular industry and in other industries, should lead to a higher level of methods, service and general business ethics. If carried on through definite channels such interchange might easily result in a combined study of the possibilities of the future and the avoidance, in the years to come, of such conditions as we are now facing. It is evident that management of labor must be elevated to a higher plane. Because labor is the major factor in most if not all industries, it should be led by recognized intelligence rather than by radical agitators on the one hand or by stupid reactionaries on the other.

Remarkable and very favorable results have been secured in labor relations and in improvement of efficiency simply by establishing frank and open conferences and free interchange of opinions, usually in genuine open shops (shops in which no prejudice or discrimination is allowed to exist either for or against men who do or do not belong to labor organizations) and some times by collective bargaining and dealing with a shop committee of which is delegated all responsibility for keeping the men to agreements fairly made between management and employees.

The great variety of designs called for by those who buy street cars, locomotives, trucks and other transportation equipment, is well known to be capable of beneficial limitation if all manufacturers and users could, through some agency, get together and by scientific study of the problems, not only from a utility or service standpoint, but from a manufacturing standpoint as well, reduce as much as possible the enormous number of varieties, styles, and types now required to be built. Many of these varieties are largely a matter of personal opinion or judgment of the buyers who have not had the opportunity to study the subject in all its phases. A great deal can be done toward standardizing the designs of these products and thus promoting the best interests of all concerned.

It will take time to bring the entire industry up to the higher level. During that time some establishments will probably be eliminated by the competition of the more advanced; but in this direction lies the only hope of eliminating industrial wastes.

Favorable Reports from the Southeast

That business, industrial and economic conditions are more nearly normal in the southeast than they have been for the past three years, is the statement made in the monthly business review of the Federal Reserve Bank of Atlanta, issued the latter part of July and covering general conditions in the sixth federal reserve district.

In part the report states:

"At this time it might be well to refer to conditions a year ago, when production, trade and business generally had reached their peak during May and June, 1920. Those who gave much thought to existing conditions realized that there must be a turning point and considerable uneasiness and anxiety were being felt. Commencing with July, 1920, production and trade began to show decreases, followed by recession of prices, values and wages. The demand for money continued, however, and contrary to former years, bank loans throughout the district increased during and after the crop-moving season in the latter months of the year, while deposits were declining. Six months after other readjustment phases were in evidence the high point of expansion of credit was reached and contraction of credit set in. The loans and investments of forty-three banks in selected cities of the district on July 6 of this year were $454,698,000, as compared with $441,924,000 on June 8, 1921, and $551,060,000 on July 9, 1920. Banks in the same reporting cities show demand deposits were $214,853,000 and $271,367,000 on July 6, 1921, and July 6, 1920, respectively. Time deposits were $145,239,000 and $151,106,000 on the same dates."

The report indicates an unprecedented revival of building activity over the whole district with Atlanta leading the other cities, and New Orleans, Jacksonville, Tampa, Birmingham and Savannah next in order.

Men of the iron, steel and kindred industries in the Birmingham district are confident that the turning point is close at hand and that from now on there will be a gradual resumption of operations at the plants in that section, with a pronounced change for the better after October 1.

The resumption of operations at No. 3 furnace of the Woodward Iron Co., at Woodward, Ala., early in August, caused a distinct thrill of optimism in iron and steel circles, for this company is now the only merchant interest in the state making iron, with two furnaces in operation. In announcing the resumption of activity, Frank H. Crockard, president of the company, stated that the stocks of iron in yards are exhausted and new orders are being received. The blowing in of the second furnace means a speeding up also at the ore and coal mines and the by-product works, and this will call for the employment of hundreds of men who have been idle for several weeks.

The Birmingham Steel Corp., manufacturers of structural steel for buildings and bridges, is cleaning up and overhauling its plant preparatory to an early resumption of operations. This action follows the dismissal recently of bankruptcy proceedings brought against the corporation.

Wire drawing mills in the Birmingham district report a larger volume of new business the latter part of July than they had experienced in some months, and in this quarter there is also considerable optimism as regards the outlook for the future.

The bar mill of the Gulf States Steel Co., at Fairfield, Ala., is now operating five days per week, this being about double the scope of the operations at the plant for the past several weeks. An influx of new orders caused the increase in activity at the mill.

The hoop and tie mill of the Conners-Weyman Steel Co., at Woodlawn, Ala., resumed operations on steel hoops the latter part of July after a long period of idleness.

Most of the pipe shops and plants in the district are operating, some of them at full capacity.

Work of the International Chamber of Commerce

Here is the way Merle Thorpe, editor of the *Nation's Business*, published by the United States Chamber of Commerce, sizes up the results achieved by the first congress of the International Chamber of Commerce, held recently at London:

Struggling through racial barriers, which at times seemed well-nigh impassible, business leaders from Sweden and Holland, Japan and Italy, Poland and Czecho-Slovakia, France and England, Belgium and Denmark, Australia and America, appreciating the gravity of the world situation, worked through hours and days to bring about, as a delegate expressed it on the floor, "a common document, a common law, a common practice, which will be accepted by all the nations, and which will make it easier for commercial men to carry on international business."

Upon scrutiny, the obstacles in the way of a restoration of the world's commerce fell into two classes: those political, and those purely of the business world.

Tackling the first, the business men reached these conclusions (the ideas are theirs, the words are mine):

"The most important factor in the resumption of normal trade is the restoration of confidence. Confidence that governments will endure and peoples will work and pay will beget adequate credit and financial resources."

Then human nature asserted itself in an "I told you so"—

"A year ago at Brussels and at Paris we emphasized the urgent need of financial reform of governmental expenditures if grave disaster were to be avoided."

"Little has been done and many of the evils anticipated are upon us."

"It ought to be apparent now that confidence and prosperity cannot be restored until all governments, yours and mine, without delay, remove burdens so largely responsible for widespread unemployment and paralysis of industry."

If governments sincerely wish the advice of business men on this business subject, it is:

1. Drive the knife deep into governmental expenses.
2. Stop printing paper money.
3. Study carefully the effect which the Inter-Allied debts and the payment and use of the German reparation will have on exchanges. We will help.
4. Disarm, according to the treaties, and thereby reduce budgetary expenses.
5. Support export credit organizations, but let private enterprise create and run them.
6. To governments with depreciated rate of exchange—don't contract new external debt.
7. Grant the greatest possible liberty to all commercial and financial transactions.
8. Remove the system of double taxation—a heavy burden on international trade.
9. The Ter Maulen plan of export credits we have examined carefully. It is all right. Support it.
10. Don't harass a foreign bank, just now of all times.
11. Consider: A tax on export of raw materials inevitably increases cost of product.
12. Don't make it so hard for commercial travelers, with burdensome, complicated, and difficult formalities as to their samples, and the slow and irritating procedure of identification.
13. Simplify passports, abolish exit visés, fix moderate fees for entrances and transit visés.
14. Government control or operation of business renders trade conditions uncertain and artificial. Desist.

These were the suggestions to governments, not flipped off as I have written them, but after days—and nights—of consideration.

Nor in the searching analysis did the delegates spare themselves. Here are some of the tasks business may do without the help of government in clearing away obstructions:

1. Arrange for a combined rail and ship bill of lading.
2. For a uniform ocean bill of lading.
3. Interpret f.o.b. and other trade terms to importers, exporters, bankers, forwarding agents, ship owners and underwriters of each and every country.
4. Reduce waste in the production and use of raw materials.
5. Learn definitely the status of construction in each country.
6. Get accurate statistics on materials essential to the world's economic life, and make them promptly available.
7. Set up machinery to settle trade disputes by arbitration, thus eliminating the law's delay and the fear of the law's delay.
8. Confer with science and religion in an effort to adopt an unchangeable calendar.
9. Standardize in factories; eliminate multifarious parts.
10. Establish on great international traffic routes through freight trains.
11. Work together for improvement of international telegraph, cable, telephone, and wireless communications.
12. Create free zones for re-exportation of goods.
13. Restore and extend pre-war international postal services; pay losses promptly; extend to all countries the system of declared values.

Chamber of Commerce Tax Recommendations

A general turnover tax on all business transactions was recommended by the Chamber of Commerce of the United States July 27 to the Ways and Means Committee of the House of Representatives, which began hearings on revenue legislation.

The committee was informed in a communication that the chamber advocates this form of sales tax as a part of a general tax program, which it is advancing as the result of a final referendum vote just completed among the commercial and industrial organizations within its membership. This referendum is the second taken on taxation within six months. The program which the chamber suggests to Congress is as follows:

Repeal of excess-profits taxes.

Repeal of war excise taxes, both those on transportation and communication, and those levied in relation to particular businesses.

A tax on all turnovers to bring in such revenues lost through these appeals as the Government's necessities require.

Decentralization of administration of income taxation.

Ascertainment by the Government of any tax based on income before payment.

A court or courts of tax appeals to be entirely separate and independent of the Treasury Department.

Net losses and inventory in any taxable year to cause redetermination of taxation on income of the previous year.

An exchange of property of a like or similar nature to be considered merely as a replacement.

Gains realized from the sale of capital assets to be subject to lower rates than income received from business or other activities.

Income from any new issues of securities, which lawfully may be made subject to federal tax, to be taxable.

Exemption of American citizens resident abroad from the American tax upon income derived abroad and not remitted to the United States.

More than 500 business organizations voted in the referendum just completed. A preliminary canvass shows that the most general demand, after a vertually unanimous demand in the previous referendum for repeal of the excess profits tax, is for repeal of the taxes on freight and express charges, passenger fares and pullman charges, and messages—i.e., for an end to the war excise taxes on transportation and communication. For repeal of these excise taxes there were 1,443 votes to 290 votes against.

The various organizations are entitled to from one to ten votes, based on their membership strength.

The next largest vote is for repeal of war excise taxes levied in connection with particular businesses—i.e., ranging from automobiles and their accessories, through theater tickets, beverages, candy, jewelry, insurance, wearing apparel, musical instruments, etc., to chewing gum.

The excess profits tax and the excise taxes, the removal of which the chamber urges, have been estimated to produce more than a billion dollars in revenue. So far as the Government's necessities require a replacement of the revenue lost through these repeals, the voting which has just closed means that the chamber would have Congress use a tax on all turnovers.

In voting for such a tax the chamber's members had an opportunity to vote for an increase in the income tax on corporations. The result of the balloting shows that they decisively preferred the general turnover tax.

The referendum which has just closed was in effect supplemental to the referendum taken in the winter on taxation. The earlier referendum was important in fixing the chamber's position upon many questions but it did not produce a definite result with respect to sales taxes. A conclusion to discussion among the chamber's membership on sales taxes has now been reached, with an unmistakable declaration for a sales tax and with designation of the general turnover tax as the type that is widely favored.

On the issue between an increase in the income tax for corporations and a sales tax, to take the place of the excess-profits tax, the voting was clear-cut in its indication of the point of view that prevails among the member organizations. One thousand one hundred seventy votes were cast for the sales tax to 108 for an increase in corporate income tax. Technically, all of these votes cannot be counted in the official canvass, but their effect is not lost since they were correctly cast upon the questions which followed and which determined the chamber's position.

On the form a sales tax should take, 1,142 votes were cast in favor of a tax on turnovers to 395 for a tax on retail sales. On the question as to which of two forms of turnover tax should be used there were 824 votes for a tax on all turnovers to 366 for a tax on turnovers only of goods, wares, and merchandise.

"In two respects the chamber's present program differs from the position it originally took," says a statement issued by the chamber. "In the referendum of last winter there were 1,217 votes cast in favor of excise taxes upon some articles of wide use but not of the first necessity, and 504 against. There were later some suggestions that a number of organizations had erred in marking their ballots, with a result that they were recorded in favor when they were in fact opposed to such taxes. However that may be, the present declaration for a sales tax of the turnover form leaves no doubt that the chamber favors a sales tax, and not excise taxes.

"The second instance involves the income tax upon gains from capital assets. Last winter the members of the chamber voted that these gains should be allocated over the period in which they were earned and taxed at the rates of the several years in the period. At the chamber's annual meeting, held in April, the delegates representing the organization members took the attitude that this would not afford sufficient relief and that if, in the maintenance of necessary revenues, such gains are to be treated as income, they should be properly defined and then subjected to more reasonable rates, these rates to be lower than on income derived from business or other current activities."

Metric Bills in Congress

On December 29, 1920, Mr. Britten, Congressman from a Chicago district, introduced a bill (H.R.-15420) entitled "A bill to fix the metric system of weights and measures as the single standard of weights and measures." This bill died with the expiration of the 65th Congress.

On April 11, 1921, Mr. Britten introduced another bill (H.R.-10) entitled, "A bill to fix the metric system of weights and measures as the single standard of weights and measures for certain uses"—the last three words being additional to the title of the December bill. The bill was referred to the Committee on Coinage, Weights and Measures, the chairman of which, we are informed, has announced that he sees no reasons "for further delay in holding comprehensive hearings on legislation looking to the adoption of the metric system as the single standard of weights and measures."

The Publicity Service of the Institute recently issued an analysis of this bill in news letter No. 53. This has been mailed to all members and others. Additional copies and a copy of the bill itself may be had upon request.

It is probable that actual hearings on the Britten bill will be considerably delayed, although Mr. Britten, on numerous occasions, has loudly proclaimed his intention to force the issue as fast as possible.

As a matter of fact the bill is a straddle. It exempts the manufacturer in part, but clamps down the metric lid tight on domestic trade and commerce. Evidently the metric party has begun to feel the weight of the condemnation of manufacturers and is now trying to lure them into an acceptance of a partial compulsory adoption by the trick of a dual system. Such a scheme could only lead to hopeless confusion and the establishment by law of a confused hybrid system with all its evil consequences. The lure will not succeed.—*From July Bulletin of the American Institution of Weights and Measures.*

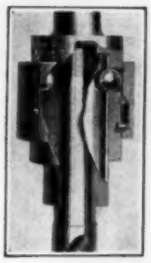
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Chuck, Drill, Quick-Change

Titan Tool Company, 26th and Holland Sts., Erie, Pa.

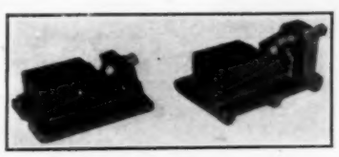
"American Machinist," May 5, 1921



The chuck is of the collet type, collets being provided to fit either straight-shank or taper-shank drills, the latter being illustrated. The speed of operation of the chuck is emphasized, it being necessary to use only one hand to insert or remove the collet carrying the drill. On taper-shank drills the tang projects through the upper end of the collet, so that the drill may be removed by merely striking the end of the tang. A special type of collet is provided for use with broken-tang taper drills, so as to give a positive drive. A positive drive is provided for straight-shank drills. The chucks are made of high-carbon steel. Because of the fact that the ring is spring actuated, it is possible to operate the chuck in any position.

Wedges, Leveling

Cincinnati Engineering Tool Co., 4659 Spring Grove Ave., Cincinnati, Ohio.

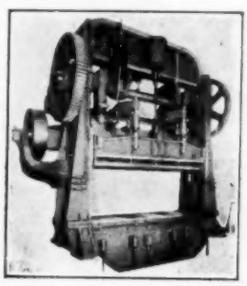


The wedges were originally developed for use in leveling planers, but it is said that, due to the accuracy of the adjustment and the convenience, they can be used successfully on all types of machines where a high degree of accuracy is to be maintained. The fine pitch screw allows accurate adjustment. The blocks are furnished in two types, the plain leveling wedge and the abutment block, the latter having an additional screw to press against the foot of the machine and to serve for moving it. The blocks ordinarily set in concrete. For merely leveling, the plain wedge is used. The abutment block serves in addition for positioning and holding the planer or other machine.

Press, Double-Crank

Toledo Machine and Tool Co., Toledo, Ohio.

"American Machinist," May 12, 1921

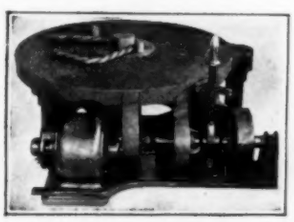


The press is said to be adapted to a wide range of work, and especially suited to the needs of builders of automobiles who do not have a sufficiently large output to warrant a power press for the performing of but one or two similar operations. A cam-actuated stripping and holding device and a spring-pressure drawing attachment are provided. The former is used in connection with perforating dies, and the latter with some of the forming dies. The press is self-contained. It is fitted with a friction clutch, which permits of the instantaneous stopping or starting of the press at any point of the stroke. Centralized forced-feed lubrication is provided. Two air cylinders are mounted on the crown of the press to counterbalance the slide. The drive is through twin gears on the main shaft, from a motor belted direct to the flywheel.

Bending Machine, Bar, No. 8

Wallace Supplies Manufacturing Co., 412-20 Orleans St., Chicago, Ill.

"American Machinist," May 12, 1921

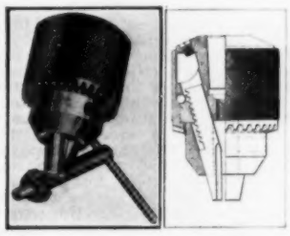


The machine is intended chiefly for the bending of reinforcement bars in large quantities, but also adapted to bending angle iron, channels, pipe, tubing and special sections. It can be furnished either with an independent motor or arranged with friction clutch pulleys for belt drive. Square twisted reinforcement bars 1⅛ in. in diameter can be bent on the machine, or two 1¼ in. bars at one time. By using extra high forming pins and rollers, small bars in quantities from 8 to 10 can be formed simultaneously. Special equipment for the bending of flats, rounds, squares, channels, angles, tees and other sections can be furnished. A motor of 7½ hp. is required to operate the machine. The approximate weight is 3,500 lb., and the floor space required is about 6 x 6 ft.

Chuck, Drill, "Super"

Jacobs Manufacturing Co., Hartford, Conn.

"American Machinist," May 5, 1921



In principle the chuck is the same as the former design of Jacobs chuck, but it has been redesigned to reduce the weight relative to the capacity and at the same time to increase the strength of the parts and give a stronger grip. The accompanying illustration shows the appearance of the chuck, as well as the interior construction. A ball thrust bearing has been added to reduce the friction of the sleeve in tightening the chuck on a drill, and the lead of the thread on the nut and jaws has been increased. The chuck is made in seven sizes, giving a capacity up to 1 in. The smallest size, which holds drills from 0 to ¼ in., weighs 7 oz., and the largest size, with a range of from ⅜ to 1 in., weighs 6 lb. 8 ounces.

Scraper, Hand

Anderson Bros. Manufacturing Co., Rockford, Ill.

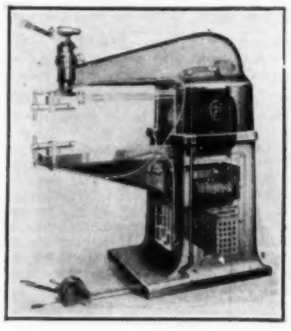
"American Machinist," May 5, 1921

The tool is an outgrowth from the development of pneumatic scrapers, since it was found necessary to obtain a special alloy capable of withstanding severe scraping service. This steel is used for the blade of the hand scraper; and it is said that it takes a greater hardness, holds a keener edge, does not scratch, and that one blade lasts as long as four ordinary hand-forged scrapers. The body is of tough steel. The clip is notched on the inside to receive and hold the blade in place, and a lug prevents the blade from slipping back. This lug causes the clip to automatically tighten when pressure is applied.

Welding Machine, Spot, Vertical

American Electric Fusion Corporation, 1906 N. Halsted St., Chicago, Ill.

"American Machinist," April 28, 1921

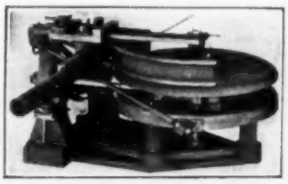


The machine is built in four sizes and designated as Type VW, the nominal throat depths of the different sizes being 12, 24, 36 and 48 in., but in each case the actual throat depth exceeds the nominal by about 8 inches. The column is of box-form and incloses all high-voltage parts of the electrical mechanism, including the switches. The lower horn support is a box-form casting that slides on ways bolted to the front of the column. The upper head is so constructed that it may be completely turned around. The welding points are copper die-castings. The total height of the machine is 76 in.; the floor space, 28 x 52 in. for a 12-in. throat; and the net weight is 1,950 lb.

Bending Machine, Pipe, No. 14

Wallace Supplies Manufacturing Co., 412-20 Orleans St., Chicago, Ill.

"American Machinist," May 12, 1921



The machine is intended for bending standard iron pipe or tubing up to 4-in. pipe size, or 4½ in. outside diameter. The roller bracket is adjustable to take forms up to 48 in. in diameter, and is operated by an eccentric lever to force the tube or pipe into a groove or form. The machine is operated by a lever, engaging friction-clutch pulleys for forward and reverse drive. Adjustable stops are provided to suit any degree of bend required. Bends can be made cold without the use of an inside follower or floating mandrel. Four-inch pipe can be bent to a radius as small as 24 in. Six standard forms are furnished with the machine, but special equipment can be provided.

Clip, paste on 3 x 5-in. cards and file as desired!

Washington Notes

By Paul Wooton
Washington Correspondent

Activities at all United States Navy Yards are practically at a standstill. All new construction has been ordered stopped. The limited forces being retained at some of the larger Navy Yards will be concentrated on work of an entirely essential character. The order already has been issued closing the naval station at New Orleans, which was an establishment calling for an expenditure of $1,000,000 a year. Other large naval activities will be suspended at the earliest opportunity.

This action on the part of the Secretary of the Navy has put a stop to the operation of a large number of plants engaged in many types of mechanical work. When the armistice was signed, these plants were employing 100,000 mechanics and related shop workers. On August 1, there still were being carried on the rolls some 45,000 of these employes, but the greater part of them were on enforced furloughs. An idea of how deep the knife has gone can be had from the fact that only 1,900 men were actively engaged in the New York Navy Yard on August 1. Even with the present reduced forces, further cuts are said to be in contemplation.

The intimation is abroad—and it comes from a source no less than the Secretary of the Navy—that we may mark time in naval activities at least until the outcome of the disarmament conference is known and possibly until the influence on naval construction of aviation, chemical warfare and the submarine may have become demonstrated more clearly. It is very evidently the idea of those who influence the nation's naval policy that the chance of war will be small during the next decade and that this offers a particularly opportune time to reduce naval expenditures.

Maj. McFarland Honored

By order of the President, a distinguished service medal has been awarded to Maj. Earl McFarland, of the Ordnance Department. During the war, he attained the rank of colonel. The citation comes for his service in designing, developing and directing the production of machine guns, automatic rifles and their accessories. The citation states that he also rendered exceptionally meritorious and distinguished service in organizing the industries of the country to meet the unprecedented demands for automatic arms created after the entrance of the United States into the war. Later, Col. McFarland was made special assistant to the Chief of Ordnance in charge of all matters pertaining to small arms, automatic arms and equipment.

Maj. McFarland is now stationed at Springfield, Mass. He is a native of Kansas and received his appointment to the United States Military Academy from that state.

Metric System Bill

Senator Ladd, who on July 18 introduced a bill in the Senate providing for the compulsory use of the metric system after a period of ten years, is making every effort to have a sub-committee appointed in order to arrange for an early hearing on the bill. It is possible that three members of the committee on standards, weights and measures can be induced to take the time necessary for these hearings, in which case the hearings may begin not later than August 15.

Representative Garner, of the House Ways and Means Committee, declared repeal of the excess profits tax, reduction of surtax to 35 or 40 per cent and an increase in the income tax on corporations are all the Ways and Means Committee will offer in tax revision.

Senate Finance Committee reported favorably the Administration bill giving Treasury blanket authority to conduct negotiations for funding of Allied debts.

A bill was introduced in the House by Representative Appleby, of New Jersey, providing a tax of 40 cents per horsepower on automobiles.

Patent Legislation Blocked

Patent legislation continues to be held up in Congress, says a statement issued by the American Engineering Council of the Federated American Engineering Societies.

"Meanwhile," the statement adds, "applications at the Patent Office during the past six months broke all records. The congestion there is becoming more and more serious. Failure to provide additional help and salaries continues to operate against efficiency under the increased load."

Death of E. A. Suverkrop

E. A. Suverkrop, whose writings have been known to the readers of the *American Machinist* for many years, both under his own name and the pen name E. A. Dixie, died July 29, aged 57 years. Among his first writings for the *American Machinist* were those concerning the doings of "Hanlon" which attracted much attention on

E. A. SUVERKROP

account of their combined humor and suggestions as to handling various mechanical difficulties.

His writings led to his becoming a member of the editorial staff on April 11, 1904, this connection continuing until July 1919, when he resigned to develop his method of manufacturing accurate gage blocks.

Born in Washington, D. C., May 6, 1864, but educated abroad for the most part, "Suver" as all his friends called him learned his trade in English and Scotch shops, largely on marine engine work. This, coupled with his love of adventure led him to the sea and as a marine engineer he visited practically all parts of the globe. His travels, together with his observing nature and an excellent memory, gave him a fund of general information which was remarkable in its variety. Whenever an unusual inquiry came into the office, the first step was always to ask "Suver" and in most cases it was unnecessary to go elsewhere for the desired information.

His work on the *American Machinist* needs no comment as it speaks for itself and while it covered a wide field of activity he was always keenly interested in extremely accurate work. His enthusiasm over the first Johansson block which came to this country helped in no small measure to popularize "Jo" blocks in the American machine shop. Always wanting to know how difficult tasks were accomplished he set about finding a method of making similar blocks in a commercial manner and patented machinery for doing this work long before he left the *American Machinist*. The development work had just been accomplished and he had begun to market his products in a small way when attacked by his last illness.

No one who knew "Suver" can forget his genial manner, his frankness, his dislike of pretence, his unselfishness, both in giving information or other assistance freely or his fund of interesting anecdotes. He had many friends in various parts of the world who will miss him in many ways. He was a member of the American Society of Mechanical Engineers and Copestone Lodge F. & A. M. He leaves a widow and three sons.

George W. Ketcham, former New Jersey State Senator, banker and manufacturer, died July 22 at his home in Newark, N. J. Mr. Ketcham was a director in the Central Stamping Co., of Newark, and was also its secretary and treasurer. He was also a director of the American Insurance Co.

Frank F. Stanley, for the past 39 years head of the Stanley Co., builders of machinery, and also president of the Stanley Marine Engineering Co., both of Swampscott, Mass., died at his home in that town July 18, aged 71 years. He was the last of the three trustees named in the will of Gordon McKay, millionaire shoe machinery builder.

Glauber Mfg. Co. to Have New Home

Purchase of the entire plant and grounds at Cleveland, Ohio, recently vacated by the National Malleable Castings Co., as the new home for the Glauber Brass Manufacturing Company, was announced Tuesday by Morris H. Glauber, owner and operator of the latter corporation.

Twenty-six factory buildings are included in the National group and the ground area covers eight acres.

The buildings in the group are all modern and of steel, brick and concrete. They range from one to four stories in height and will require little alteration to suit the requirements of the Glauber company. Work on the necessary changes has already begun.

According to Mr. Glauber, plans are being worked out for incorporating on a larger scale, and provision made for taking over other large brass concerns.

Investigating the Corrosion of Soft Metals

The results of the investigation by the Bureau of Standards of soft metals have been assembled and work on a publication will soon be started. The investigation was conducted for the purpose of determining to what extent inter-crystalline embrittlement occurs in the soft metals—zinc, aluminum and tin, as a result of prolonged corrosion. The behavior of lead has previously been studied. An additional study of the last-named metal to show the accelerated influence of applied stress in causing embrittlement by corrosion was also made.

New Publications

Statistical Abstract of the United States, 1920. Issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, and printed by and sold through the Government Printing Office, Washington, D. C.

A volume of condensed statistics, mostly in tabular form, covering practically every phase of our national life. It is a very complete work and contains valuable information to every business or professional man.

The Advertising Handbook. By S. Roland Hall, former advertising manager of the Alpha Portland Cement Co., and Victor Talking Machine Co., and former principal of the International Schools of Advertising and Salesmanship; contains 743, 5 x 7-in. pages and is published by McGraw-Hill Book Co., 370 Seventh Ave., New York City.

This is a book that should be of great value to everyone having to do with advertising in any of its phases. Especially valuable to the business man interested in some degree in advertising who wants detailed, definite information, and to the younger man studying the art of advertising.

It is the best text book on advertising that we have seen. It is one of the most constructive and useful books on advertising that has yet been compiled. It contains a certain amount of the right kind of theory of advertising and is also intensely practical. It is profusely illustrated with advertisements that have been actually used. The typography is excellent and the arrangement makes it easy to find any subject in which the reader is interested.

History of the Shipbuilding Labor Adjustment Board, 1917 to 1919. By Willard E. Hotchkiss and Henry R. Seager, of the Board: Bulletin No. 283 of the U. S. Bureau of Labor Statistics, published at the Government Printing Office, Washington, D. C.

A comprehensive history of the work of the Shipbuilding Labor Adjustment Board covering the period of its existence as a war emergency organization. Its several chapters tell of the operations of the board in settling labor difficulties and rendering awards in the various shipyards under Government control. In the appendix are given tables showing the wage rates established by the board.

The authors are capable administrators, Mr. Saeger being professor of political economy at Columbia University, and Mr. Hotchkiss director of the National Industrial Federation of Clothing Manufacturers.

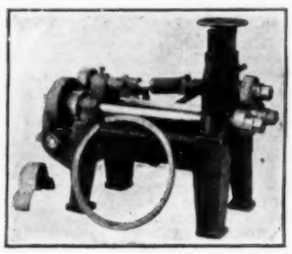
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Furnace, Heat-Treating
Bellis Heat Treating Co., Blake and Valley Sts., New Haven, Conn.
"American Machinist," May 12, 1921

The company is prepared to install furnaces and supply crucibles and salts for the Bellis process of heat-treating high-speed and other steels. For high-speed steels a triple-unit furnace, shown in the illustration, is used. Though burners are supplied for all three chambers, those in the outer chambers are for the purpose of bringing the furnace quickly to working temperature, after which they may shut off and the relative heats maintained by the flame from the central chamber. Either gas or oil burners are used. They are set tangentially in circular chambers, so that the flame does not impinge directly upon the crucibles. Crucibles for the higher temperatures are made double, with an outer shell of special refractory material and a lining of steel, which does not react chemically to the molten heating compound.

Coiling Machine, Ring No. 3
Wallace Supplies Manufacturing Co., 412 Orleans St., Chicago, Ill.
"American Machinist," May 12, 1921



The machine is intended for the manufacturing of rings and coils. The rolls are removable and can be changed to suit the character of the section to be bent, handling angles, channels, tees, tubes and bars of standard or special section. Angle iron 2 x 2 x ¼ in. in size can be bent cold to a circle as small as 30 in. in diameter, while lighter sections can be bent to smaller circles. Twisted or deformed structural bars can be bent, as in the forming of helices such as are used for reinforcing concrete columns. The position of the upper roller is adjustable by means of a hand-operated screw to give the required diameter to the coil or ring. The machine occupies a floor space of 42 x 54 in. and weighs 1,200 lb.

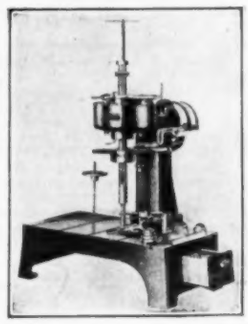
Drafting Outfit
Simplex Tool and Instrument Co., 820 N. Third St., Camden, N. J.
"American Machinist," May 12, 1921

The equipment consists of a frame carrying the board, on which is mounted the parallel-ruling device holding the scales. The board may be placed in either a horizontal or a vertical position. The sliding horizontal board shown underneath the main board forms a table to hold reference drawings up to 24 x 40 in. in size. Removable casters are supplied. A drawer and tray are provided at the side of the machine for holding pencils and drawing tools. At the top of the board is a track on which runs a carriage holding the bar that extends across the board. An indexing head is mounted on the bar. Two scales placed at right-angles are held on the head, the scales being swiveled easily by means of the left hand.

Chuck, Bushing, Grinding-Wheel
Commercial Welding and Machine Co., Inc., 21 Commercial St., Worcester, Mass.
"American Machinist," May 12, 1921

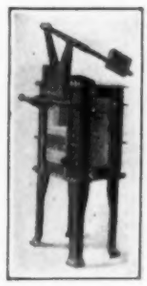
The chuck is intended for use in the bushing of grinding wheels. The device embodies two independent chucks, one holding the bushing arbor, and the other the wheel or part to be bushed. It is said that the work is centered accurately, and held so that the hole will be at right-angles to the side of the wheel. The device is dust proof. The work holding chuck is said to be very substantial, but adjustable to a fine degree and sensitive enough to hold delicate work without straining or breaking it. It is made in an 18-in. size, mounted on three legs. A lathe chuck is also made in a 12-in. size for turning abrasive wheels. Arbors on which to cast the bushings can be furnished in sets from ½ to 5 in. in diameter. The arbor chuck and the wheel chuck are adjusted by means of wrenches on separate screws on the periphery.

Boring Machine (Re-), Cylinder, No. HM7
Hinckley-Meyers Co., 19 N. Michigan Ave., Chicago, Ill.
"American Machinist," May 12, 1921



The machine will rebore open-head cylinder blocks not exceeding 20 in. in height and having cylinder bores from 2½ to 5 in. in diameter. The table is low, so that the motor blocks can be easily placed in position. The pilot bar is lowered through the cylinder, centering in a hardened bushing in the table. A hardened, split and tapered centering fixture is used to locate the cylinder block. The cutter head contains three adjustable cutter blades. It is mounted on the boring or cutter bar, which is maintained in its proper relation to the cylinder by traveling over the pilot bar. The cutter bar is driven at the speed of about 40 r.p.m. It is fed automatically and is provided with an adjustable stop collar. The machine consumes only about 1 hp. in operation. The floor space required is 50 x 40 in. and the weight 1,500 lb.

Furnace, Hardening, Tool
Advance Furnace and Engineering Co., Springfield, Mass.
"American Machinist," May 12, 1921

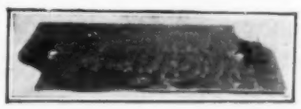


The furnace is of the semi-muffle type in which the flame chamber is located below the floor of the heating chamber, the heat being conducted to the latter by flues. The burner is located in the rear of the furnace and may be adapted to the consumption of either gas or oil fuel. The door is suspended on three radius rods, so that when it is lifted it does not drag the hot firebrick lining against the furnace front, but swings away in a long arc, and comes to rest against the furnace front again when it reaches the full open position. The furnace shown is for handling carbon steel only. Furnaces for heating high-speed steel have an additional heat-insulating covering and a sheet-iron jacket.

Truck, Industrial, Crane, Electric
Elwell-Parker Electric Co., Cleveland, Ohio.
"American Machinist," May 12, 1921

This low-bed electric industrial truck has been equipped with a crane, thus adapting it for loading, hauling and tiering. It is said that the crane can pick up 2,000 lb., and can stack material to a height of 8 ft. The truck itself can carry a load of 3,000 lb., and travel from 300 to 400 ft. per minute. The revolving crane column is carried on large ball and roller bearings and can be swung by hand. The boom may be raised or lowered and locked in any position desired. The power for this movement is obtained from the same motor that winds the cable, the hoisting mechanism being so mounted as to counterbalance the load. All four wheels are used for steering and the two rear ones for driving. The crane may be fitted with an 18-in. magnet for the handling of scrap material.

Match Plates, Metal
St. Louis Machine Tool Co., 932 Loughborough Ave., St. Louis, Mo.
"American Machinist," May 12, 1921



This line of steel and aluminum match plates is adapted to light and medium foundry work. The patterns are secured to the plates, thus insuring that the cope and drag parts of the molds will fit each other properly. The plates consist of flat sheets of metal, each provided with clamps and guides for fitting the flask pins. They are made either round, rectilinear or in any shape desired, and with the ears in the center or at diagonal corners. They are ordinarily used for work done in large quantities, and usually in connection with a molding machine. The plates are made in ten standard sizes. The steel plates vary in thickness from ¼ to ½ in. The aluminum plates vary from ½ to ¾ in. in thickness, and are said to be lighter than the steel plates and non-corrosive.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The contract for a $60,000 factory has been placed by the Multiple Storage Battery Co., Jamaica, N. Y. Plans call for a structure one story high, 60x125 feet.

The Cu...berland Machinery Co., Cumberland, Md., has established a modern machine shop for the repair of automobiles. About thirty mechanics are employed.

The War Finance Corporation has announced that it has agreed to make an advance of $250,000 to an exporter for the purpose of assisting in financing the exportation of sugar mill machinery to Cuba.

The Oxford Steel Products Co., Boston, Mass., has been incorporated with $300,000 capital by Clarence E. Dodge, Maurice T. Viall, Cranston, R. I., and Edwin C. Burbank, Malden, Mass.

The George C. Herron Co., Boston, Mass., has been incorporated to deal in power machinery with $20,000 capital by George C. Herron, I. J. Herron and Arthur H. Herron, Jr.

Lockwood, Greene & Co., Boston, Mass., mill engineers, are making plans for a steel frame, limestone front, fireproof, 11-story, 80x70-ft. building, of which they have leased the nine upper floors for occupancy.

The Maynard Co., Chelsea, Mass., has been incorporated to deal in machinery, tools, apparatus, etc., with $25,000 capital by Raymond P. Maynard, B. E. Bixby, Waverly, Mass., and Frederick C. Parow.

The L. A. Derby Co., Lowell, Mass., has been incorporated with $50,000 capital to handle electrical and mechanical engineering work by Lucius A. Derby, Frank H. Derby, Morton V. Loud and others.

The Boston & Maine railroad (offices at Concord, N. H.,) has let the contract for the erection of a brick and concrete roundhouse, office building and sandhouse to cost $200,000.

The International Marine Life Saving Equipment Corp., New York, N. Y., marine specialties, has been chartered with $520,000 authorized capitalization by Michael Johnell, John E. Ellys and others.

The Adams Distributing Corp., New York, N. Y., with $30,000 authorized capital, has been incorporated for the distribution of hardware and other articles. The incorporators include H. J. Otis, C. A. Borhein and others, 30 Pine Street.

The Lancaster Machine and Auto Repair Co., Lancaster, Ohio, has been incorporated with $8,000 capital stock by Paul Herbert, Joseph Welsh, James Walter and George W. Vorys.

The Marcy Tool Works, Inc., 79 Walnut St., Putnam, Conn., has recently incorporated with a capital stock of $100,000. The incorporators are A. W. Marcy, M. Marcy and H. Devine, all of Putnam.

Reliance Boiler Works, Pittsburgh, Pa., capital $40,000, has been chartered to erect and repair steam boilers by H. C. Feldstein, Raymond M. Collins and William Oloen.

The capital stock of the Oilgear Co., Milwaukee, Wis., a comparatively new concern, has been increased from $200,000 to $300,000 of preferred and 5,000 shares of non-par valued common shares.

Articles of incorporation have been filed by the Acme Valve Grinding Machine Co., Milwaukee, Wis., organized with $25,000 capital stock by B. A. Roberts, George W. Leitsch and George A. Fullips, 3507 Chambers Street.

The Southern Iron & Steel Co., Louisville, Ky., with $100,000 capital, has been incorporated by M. O. Curd, E. M. Drummond, James Drummond and others, all of Louisville.

The National Slag Production Co., Hamilton, Ont., has secured premises here and will establish a plant. Slag from the plant of the Steel Co. of Canada, Hamilton, will be utilized. The company is capitalized at $300,000 and is headed by Edwin J. Robertson.

Builders Steel Works Co., Pittsburgh, Pa., with a capital of $50,000 to manufacture iron, steel and metal products, etc., has these incorporators: William H. Miller, Bellevue; B. B. McGinnis, Pittsburgh; Roscoe H. Brunstetter, Wilson, Pa.

The Lindquist Engineering Works, Portland, Conn., has recently incorporated the business under the State Laws of Connecticut. At a meeting held last week the following officers were chosen: C. O. Hedstrom, president; T. C. Flood, treasurer and secretary; E. A. Lindquist, vice-president.

The plants of the Delco Light Co., Dayton, Ohio, manufacturer of electrical appliances and lighting plants, and the Burnett-Larch Manufacturing Co. report increase in sales of their products. The increased demand necessitated the employment of about 600 additional men.

The Tulsa Stove and Foundry Co., Sand Springs, Okla., manufacturer of grey iron, brass and aluminum castings, has completed a new plant and the old plant has been taken over by the Sash Weight Foundry Co. for the manufacture of sash weights.

Announcement was made last week of the sale of the plant of the Ungar Sheet Metal Products at Youngstown, Ohio, to Fred S. Ullman and Samuel H. Weinreich. It is understood that Ullman and Weinreich will incorporate a new company with a capital of $50,000 to manufacture all kinds of sheet metal products.

The Yonker Manufacturing Co. has been chartered with a capital of $50,000 to manufacture and deal in machinery, machine tools, etc. The incorporators are C. F. Souder, F. H. Newton, John H. Yonker, Harry L. Christ and LeRoy H. Geller, all of Toledo, Ohio.

Stringers Bros Co., Gadsden, Ala., which is incorporated for $200,000, has a new plant under construction. The company will purchase equipment for a brass and iron foundry suitable for the production of plumbing specialties. Charles C. Stringer, Chicago, is president, and F. G. Wineman is treasurer.

The Alabama Power Co., Birmingham, Ala., plans erection of a hydro-electric power plant at Duncan's Riffle, on the Coosa River. This will call for a dam 1,800 feet long and 74 feet high. It is estimated the entire cost will be approximately $25,000,000.

The suggestion system at the plant of the National Cash Register Co., Dayton, Ohio, originated by John H. Patterson in 1894, has resulted in total payments of more than $92,000 for suggestions. Nearly 83,000 suggestions have been submitted by employees, and more than one-third of these have been adopted.

During the last suggestion contest about 6,400 suggestions were received. Eight thousand dollars in prizes will be awarded to employees who made the best suggestions.

Improvement in conditions in the iron and steel industries in the Alabama district is indicated by the fact that the melt of pig iron in the district is on the increase. Cast iron pipe makers, manufacturers of radiators, and the various sanitary pipe plants in the district are experiencing a gradual increase in business, and while this is not sufficient to bring about much improvement in the buying of pig iron, the plants are purchasing as their needs present themselves and improvement is noted that portends better times in the near future.

Pipe makers in the district are now operating on a 60 per cent capacity basis on the average. The building boom throughout the country is having a favorable effect. Men of the industry believe there will be a considerable demand for pipe and fittings the remainder of the year, and that the melt of the necessary metal may start up shortly on a lively scale.

Personals

Ernest T. Clary, assistant works manager of the Whitin Machine Works, of Whitinsville, Mass., has recently been chosen production manager for the plant.

Donald P. Hess has become general manager of the Columbus plant of the Timken Roller Bearing Co., succeeding C. N. Replogle, resigned. Mr. Hess has been connected with the Timken company at its Canton, Ohio, plant for almost three years.

W. K. Swift, manager of the New England sales branch office of the Ingersoll-Rand Co., New York, N. Y., for the last eight and a half years, has resigned. Mr. Swift has not announced his plans for the future.

Roy Davey, who has been manager of the Detroit Branch for the American Bosch Magneto Corporation, has been promoted to the position of manager of the manufacturer's trade department. Mr. Davey will be located at the main office at Springfield, Mass.

W. R. Milner, body engineer of the Cadillac Motor Car Company, has resigned to join the engineering staff of R. H. Collins, who recently withdrew as president and general manager of the Cadillac Motor Car Company to build a high-grade automobile bearing his own name.

E. B. Germain, for three years general manager of the Harlan plant of the Bethlehem Shipbuilding Corporation, has been advanced to a more responsible and important position with the Bethlhem interests in connection with its general sales department. W. Weaver, of Wilmington, Del., who has been superintendent of the Harlan yard, will be advanced to Mr. Germain's position.

Stuart F. Brown, for several years in charge of the production department of the Whitin Machine Works, Whitinsville, Mass., has become agent for the Whitinsville Spinning Ring Co.

Henry D. Warner, a former manufacturer in Bristol, Conn., who has been selling second hand machinery in that state for several years, has established new headquarters at 26 High Street, Hartford, Conn.

F. E. L. Whitesell, who for some years was with the sales department of the Railway & Industrial Engineering Co., Greensburg, Pa., has been appointed its New England representative with headquarters in Boston.

W. H. Jackson has been elected president of the Pittsburgh-Des Moines Steel Co. to succeed E. W. Crelin, retired. O. E. Guibert and W. W. Hendrix were elected vice-presidents and George A. Smith, secretary and treasurer. Mr. Smith will be located in Pittsburgh, and A. C. Pearsall has been appointed general manager of the Des Moines branch.

Charles N. Holdredge, for the past 15 years assistant superintendent of the Hemphill Mfg. Co., Central Falls, R. I., builder of machinery, has resigned to enter business.

L. C. Bewsey, electrical and mechanical engineer and an expert on railway construction and operation has been appointed superintendent of the Michigan Railway company's lines in Kalamazoo, Mich.

Henry C. Walker and John A. Lind will open the Walker Machine Works, 2126 Folsom Street, San Francisco, Cal. The shop will be equipped with a complete set of lathes and machines for the conduct of a general machine shop.

John L. Key, Call Building, San Francisco, Cal., has been appointed the Pacific Coast representative for the Forges de La Providence Societe Anonyme), Marchienneaupont, Belgium, and will handle the full line of steel products manufactured by that company.

William L. Urquhart, export manager for the Hart & Hegeman Mfg. Co., Hartford, Conn., has been appointed British vice consul for the port of Hartford. He is the first British vice consul in any Connecticut city. Mr. Urquhart will retain his position with the Hart & Hegeman Mfg. Co.

E. A. Keithley, Rialto Building, San Francisco, representing the Central Foundry, Essex Foundry, Milwaukee Brass Mfg. Co., H. O. Canfield Co., G. M. Davis Regulator Co. and the Pittsburgh Valve Foundry & Construction Co., has opened offices in the Alaska Building, Seattle, Wash. Mr. Keithley's son, E. L. Keithley, has been appointed manager.

Norman W. Warren, for the last five years western manager of the Dominion Bridge Co., Ltd., with headquarters in Winnipeg, has been promoted to general manager for the Dominion of Canada of the company and will be located in Montreal, Canada.

H. C. Dickinson, who has been for some years chief of the automotive investigations division of the Bureau of Standards, has been granted a year's leave of absence from the bureau to become director of research of the Society of Automotive Engineers. He will, however, continue in some measure to co-operate in the Bureau of Standards investigations by giving a small amount of his time to conference and direction of the work of this division. Work of the S. A. E. on research will not include any experimental investigations by the society itself, but will deal rather with an exchange of research information, the general study of research in progress within the industry, and of interest to it, and an effort to secure proper arrangements for additional research work which is not now adequately cared for.

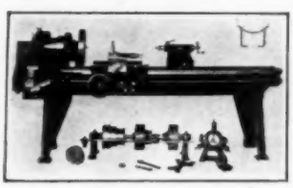
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Grinders, Power-Head
J. L. Austin Mfg. Co., Milwaukee, Wis.
"American Machinist," May 12, 1921

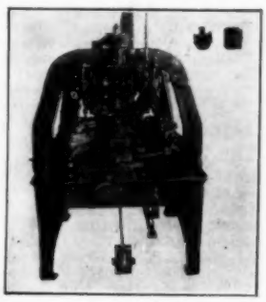
The machine is made in three sizes to carry wheels 8 x 1 in., 10 x 1½ in., or 12 x 2 in. in size, respectively. It can be furnished either with or without the pedestal, and with single-pulley or double-pulley drive, the latter being used on the machine shown. The arbors are of high-carbon steel and run in babbitted bearings that are split to take up wear. The collars are pressed onto the arbors, and counterbored for the purpose of excluding dirt and dust from the bearings. The rest arms are equipped with both an angle and a bevel tool rest, and the back bracket is eliminated for the purpose of allowing more room around the wheel. The wheel guards are one-piece grey-iron castings.

Lathe, Quick-Change, 14-Inch
A. V. Carroll Machine Tool Co., Norwood, Cincinnati, Ohio.
"American Machinist," May 19, 1921



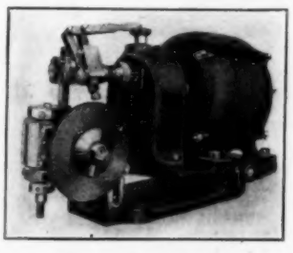
The chief feature to which the maker calls attention is a gap by which the swing over the ways is increased to 19 in. for chuck and face-plate work. The gap in the bed is not visible from the front or the back of the machine, since only the inner ways are broken. The small sketch at the upper right-hand corner of the illustration shows the construction used for the gap bed. The drive is by belt on a cone pulley. Either double or single back gears can be furnished. By the positioning of one knob and handle, 24 changes of feed, either right or left, can be obtained. The lead screw has a 4-pitch thread, and is adjusted by means of a threaded collar. The machine can be furnished in lengths of bed of 6, 8, 10 and 12 feet.

Drilling Machine, Multiple-Spindle, Automatic, Special
Langelier Manufacturing Company, Providence, R. I.
"American Machinist," May 19, 1921



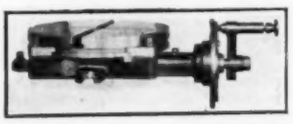
This is a six-spindle machine of the dial type for drilling the tumbler holes in pin-tumbler lock cylinders. The machine operates upon the progressive principle. Seven positions are provided, one for each of the six holes and one for unloading and reloading. The jigs are so arranged as to open and close automatically. A slide at each position carries a short, horizontally projecting arbor fitting the plug-hole in the cylinders to be drilled. A bushing plate guides the drills. The main drive of the machine is by belt to the pulley at the upper end of the vertical, central shaft, from which all the movements are derived. The spindles run at 5,000 r.p.m. and are mounted upon ball bearings. The dial is moved by a modified form of the "Geneva" gear.

Attachment, Milling and Grinding, Thread, "Universal"
Automatic Machinery and Equipment Co., 1110 Land Title Bldg., Philadelphia, Pa.
"American Machinist," May 19, 1921



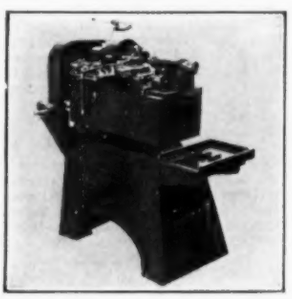
The machine is intended for attachment on the tool block of a lathe for use chiefly in milling and grinding threads and worms. The machine will mill, flute and grind a tap in one setting, besides milling worms and cutting gears and ratchets. The illustration shows the Size "A" machine, fitted for grinding. There is a spindle, shown at the bottom of the spindle head, for holding the milling cutter. The head can be swung to bring the spindle in the desired position, it being graduated for the full 360 deg. to facilitate setting. The driving motor is mounted on a base hinged on the main base, so that the spindle can be raised or lowered. The length of the machine is 14½ in., the width 6 in., and the height 8 in. The weight is about 45 lb.

Table, Indexing, Rotary
Rhodes Manufacturing Co., Hartford, Conn.
"American Machinist," May 12, 1921



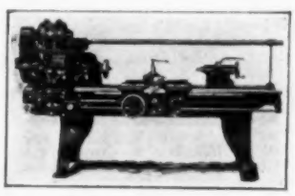
The table is intended primarily for use in connection with the company's shapers, but is equally serviceable on a milling machine or drill-press. Slotted ears on three sides of the base and a hole through the index bracket on the fourth side provide a way to bolt the device to a machine table. Three index plates are provided, with which any number of divisions up to 360 may be obtained. Adjustable plugs of hardened steel provide means of compensating for the wear of the worm and the wormshaft bearings. The table is graduated in degrees, thus enabling the operator to make angular settings. Four clamping plates hold the table firmly in any position, when desired. The diameter of the table is 8 in., and the total height of the device above the machine table, 2½ inches.

Lathe, Screw-Cutting, Precision
Alfred Herbert, Ltd., Coventry, England, and 50 Church St., New York, N. Y.
"American Machinist," May 19, 1921



The bed of the machine is of box section and rests on three balls so secured to the base as to allow free expansion or contraction with temperature changes. The headstock is fitted with a three-step cone pulley, driving the spindle through gears with a speed reduction of 4 to 1. The lead screw is, in turn, geared to the spindle. The work center does not revolve. The tailstock has a fine adjustment across the bed. The saddle carries two slides, the top one having an eccentric bushing which permits adjustment of the height of the tool. The lead screw has a square thread, there being eight threads per inch. It is placed between the V's of the bottom slide and is ¾ in. in diameter. A solid nut is used. A pitch-varying attachment is provided.

Lathe, Geared-Head
Morris Machine Tool Co., Court and Harriet Sts., Cincinnati, O.
"American Machinist," May 19, 1921



The company has fitted with a geared head and single-pulley drive its quick-change lathe. The machine is driven by an individual motor mounted on top of the headstock. It is made in swings of 16, 18 and 22 inches. The head provides twelve spindle speeds. The speed range for the 16-in. lathe is 12 to 347 r.p.m., while it is 10 to 297 r.p.m. for the 18- and 22-in. lathes. All speeds are secured through sliding gears and one positive back-gear clutch. The only friction clutch used is in the pulley at the initial drive. When releasing the friction clutch in the pulley a brake can be applied by the same pull to stop the idle rotation of the spindle. The geared head is interchangeable with the cone head and arranged to receive the motor-drive unit.

Gage Block Holder, Micro-
Van Keuren Co., 361 Cambridge St., Allston, Boston, Mass.
"American Machinist," May 19, 1921

This set of accessory measuring tools is for use with combination micro-gage blocks. The device is a holder for the gage blocks and the measuring points, forming a caliper. The micro-gages, which are round in shape, permit the use of a light steel tubing for the frame or clamp to hold them and the jaws. The micro-gages are inserted in the lower or open end of the tube, and the jaws are inserted in ¼-in. slots. The clamp has a range up to 7 in. Small dimensions are secured with the jaws in the central slot. For long combinations the two end slots are used. The set includes two flat jaws, two plain and two scribing plugs.

Clip, paste on 3 x 5-in. cards and file as desired

The Belgian Machine Tool Market

(Acting Commercial Attaché Samuel H. Cross, Brussells, in Department of Commerce Reports)

While it would appear natural that a country in which transformative industries are as important as in Belgium, and which presents a highly developed iron and steel industry, would produce a large variety of machinery, Belgian production in this respect has been limited to certain special lines. The tendency to restrict production, except in the case of heavy machinery, to relatively small shops has naturally prevented standardization, while the limited character of the home market provided little stimulus in this direction. Bulk production has therefore been confined heretofore to articles that best sustain foreign competition in export markets on account of their low labor cost and superior quality.

The best-known branch of Belgian mechanical construction is locomotive and engine building, which centers in the Hainaut section, Ghent, and Liege. Beside standard and narrow-gage railway locomotives, the industry produces steam turbines, gas and oil engines for marine and industrial purposes, compound marine engines, and horizontal engines for river craft. Gas engines are generally used in Belgian metallurgical plants, and produce in some cases as high as 8,000 horsepower. Diesel motors are also constructed at Ghent, and are admitted to compare favorably with similar engines of German construction. Belgian steam engines and locomotives are well known for their relatively low coal consumption. Since the armistice, however, owing to the lessened repair and construction facilities of Belgian locomotive shops, the Belgian State railways ordered locomotives both in the United States and in England. The American locomotives have now been delivered (150 in number), and are, according to official statements by government engineers, rendering superior service.

Electrical construction, though a field of more recent development, is represented by large plants at Charlerol, Ghent, and Antwerp, turning out dynamos, motors, transformers, storage batteries, switchboards, telephone apparatus, cables, and a varied line of accessories. American capital is considerably interested in this branch of Belgian industry, which employs approximately 8,000 workmen.

Machine Tool Production

There are only four important Belgian plants manufacturing machine tools, two located in Brussels, and one each at Liége and Bruges, producing a relatively limited variety of implements. One of the Brussels plants specializes on lathes of 14 to 40-in. dimensions, while the other, which is now increasing its installations to a capacity of from 1,000 to 1,200 machines a year, builds lathes, shapers, and pneumatic hammers of good quality. The Bruges plant, aside from refrigerating machinery, turns out several models of boring mills which are considered equal to any similar makes produced outside the United States. The principal export markets for Belgian machine tools are France, England and Italy. Belgian toolmakers have frequently imitated American machines, and one case is noted where an imitation of a small American drilling machine sells for 650 francs, in comparison with 1,200 francs asked for the original. The prices for Belgian tools run in general from one-third to one-half of those charged for their American equivalents. For instance, a plant at Liége turns out a wheel lathe selling for one-third the price of a well-known American make. On the other hand, its weight also is only one-third of that of the American machine, and it may be reasonably supposed that its comparative durability is in proportion.

There is also one fairly large Belgian plant producing woodworking machinery, mostly of lighter sorts in comparison with the products of Swedish manufacture. This factory, which has an annual turnover of 15,000,000 francs, relatively large for a Belgian enterprise of this nature, is reported practically to control the French market for machines of this type.

Competition with American Tools

Local machine tool dealers state that before the war 70 per cent of all machine tools imported into this country were of German origin. For reconstruction purposes after the armistice, however, American machine tools of all classes, from the smallest millers to the heaviest grinding wheels and boring mills, were sold in Belgium in large numbers. The War Department alone disposed of $3,500,000 worth of tools through the co-operative known as the Construction Métallique, and it is estimated that fully as large a sum was spent on machines purchased privately. Though these large American sales created a temporary advantage, this preferential position was rapidly lost as soon as German machines, at relatively low prices, re-entered the field. While it is generaly recognized by Belgian machine tool users that German products are not of the same high quality (lathe beds, in particular, being made of inferior metal), local enterprises are now making stop-gap purchases of German tools to hold them over until a fall in the dollar makes it possible to acquire American tools at what they consider a more reasonable price. Several agents for American machine tools who carried large stocks suffered severe losses during the latter part of 1920 and owing to the readier sale of German products, one such agent at least has taken an agency for German machines. The sale of American tools must obviously suffer from this practice if it spreads further. The sale of German machine tools, except in this instance, is in the hands of relatively small and unimportant commission houses whose sharp methods and price cutting render matters difficult for the more reputable agents. While German manufacturers have been demanding cash with order, they rarely insist on this condition when a sale depends upon concessions.

Market Conditions

The shop and factory supply business, so far as American products are concerned, is now more profitable than the machine tool field. American wheels and small tools of most sorts sell with relative ease, but the market is practically closed to American twist drills. Not only do English twist drills offer some active competition, but prohibitive offers from German firms are beginning to appear. While there are in Belgium numerous small shops producing brass valves, the native product is not able to compete with the standardized American article.

German competition is particularly active in measuring tools and on small carbon steel articles. In the latter branch German manufacturers undersell American products in the local market by over 80 per cent. A 36-millimeter carbon drill is being offered in Brussels for 6.25 francs in comparison with 35.15 francs asked for a well-known American drill of the same size. It is the local practice to use carbon steel up to one-half inch diameters and above that dimension to employ high-speed steel. German price offers on micrometers are almost as exclusive as on drills. A German product, not of extremely high finish but of entirely accurate construction, is sold in Brussels for 31.20 francs, while the price asked for the corresponding American micrometer is 96 francs.

German tools of this sort placed on the local market bear no device or mark indicating their Teutonic origin, and even for an order of one such micrometer, the German manufacturer will stamp on it the name and address of the local purchaser free of charge.

Value of Farm Implements Manufactured Last Year

Gas tractors to the number 203,000 with a total value of $193,000,000; more than 1,000,000 plows with a value of over $40,000,000; 225,000 farm wagons with a value of nearly $25,000,000; and 412,000 haying machines with a value of nearly $25,000,000, were manufactured in the United States during the year 1920, according to detailed reports from 583 manufacturers summarized by Bureau of Public Roads, United States Department of Agriculture. The total value of implements manufactured was $537,000,000, and gas tractors constituted more than one-third of the total.

Southern Iron Stocks

Conviction is growing in the Birmingham district that the bottom has been at last reached in the iron and steel markets, and that price hammering is about to stop. Generally speaking, the present period seems to be regarded as one between tides, the ebb having been completed and the inward tide being about to start.

Stocks of iron in the yards of the producers are small and production is at a minimum. These yard stocks are reported to be becoming more and more ill-assorted, so that the melter finds it difficult to secure iron the analysis of his choice. Many shapes and lengths of cast-iron pipe are not in the yards. Some steel products are in the same condition.

Five mills of American Sheet & Tin Plate Co., at Cambridge, Ohio, resumed operations.

Small Tools Moving

Small tools are moving in a quiet way, but no large lists recently have appeared on the market. In the majority of cases machinery and tool prices remain unchanged, but dealers state that a reduction of approximately 10 per cent has gone into effect on twist stock carbon and wood boring drills. The revised discount is now 42½ per cent.

Technical Catalogs and Magazines Wanted

The director of the Government industrial school for mechanicians and commercial students at Vigo, Spain, would be pleased to receive any catalogs and magazines (preferably, but not necessarily, in Spanish) having to do with machinery and mechanics, that American firms may care to send him. Some funds are available for subscriptions to magazines, and after seeing specimen copies, the director will choose those that are most suitable. Send communications to the following address: El Sr. Director de la Biblioteca Escuela de Artes y Oficios, Vigo, Spain.

Forthcoming Meetings

The third annual convention and exhibition of the American Society for Steel Treating will be held in the Manufacturers Building, State Fair Grounds, Indianapolis, Ind., during the week of September 19 to 24 inclusive.

The annual congress of the National Safety Council will be held at Boston, Mass., during the week of September 26. C. W. Price, 168 North Michigan Ave., Chicago, Ill., is general manager.

A joint meeting of the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Army Ordnance Association will be held at Aberdeen, Md., Friday, October 7.

The National Machine Tool Builders' Association will hold its Fall Meeting at the Hotel Astor, New York City, October 18, 19 and 20.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A firm in Norway desires to purchase a complete equipment for sand and gravel plants, especially conveyers and conveyer belting. Quotations should be given c.i.f. Norweigian port or f.o.b. Atlantic port. Cash to be paid. Reference No. 35230.

A manufacturer in Mexico desires to purchase machinery for making tin cans and containers for alcohol, petroleum, etc. Quotations should be given c.i.f. Mexico or f.o.b. factory. No reference offered. No. 35235.

A merchant in the Dutch East Indies desires to purchase cocoanut shredding machinery, soap-making machinery (laundry soap only), and machinery and equipment for a tapioca mill. Quotations should be given c.i.f. Batavia. Terms: Cash against documents in New York. Reference, No. 35,242.

A development corporation in Sumatra desires to purchase machinery for the manufacture of barrels for the transportation of palm oil. Quotations should be given c.i.f. Sumatra. Reference No. 35251.

An industrial company in Belgium desires to purchase 500 to 1,000 household hand pumps and 500 to 1,000 semirotary valve pumps. Quotations should be given f.o.b. American port or factory. Designs of the pumps are requested. Reference No. 35252.

A municipality in a Central American country is soon to install a modern water and power system and requires piping, fittings, tools and other equipment. Quotations should be given f.o.b. American port. Cash to be paid. Correspondence preferred in Spanish, though English may be used. No. 35254.

NEW and ENLARGED

Machine Tools and Machinery Wanted

Machine-tool wants published without charge

Conn., Bridgeport—M. J. Dowling & Co., 586 Gurdon St., manufacturer of building supplies and equipment—one 12 in. x 5 ft. lathe (used), and a small planer.

Conn., Bridgeport—W. Stowe & Bro., 810 Madison Ave.—small lathe for garage.

N. J., Camden—The Bd. Educ., City Hall, will receive bids until Aug. 22 for equipment for machine, forge, sheet metal, foundry and woodworking shops.

Ill., Greenfield—The Bd. Educ.—manual training equipment for the proposed high school.

Mich., Saginaw—Niles Machine Co.—one 10 spindle ¾ in. multiple spindle drill.

Ala., Birmingham—Welded Products Co., 2701-9 North 7th Ave., E. Moses, Pres.—combined punch and shear of capacity ¾ in. holes in ¾ in. plate, might consider one for ½ in. holes in ½ in. plate, approximate depth of throat 6 in. Short lathe with 20 in. swing. Lathe with approximately 8 to 10 in. swing.

Fla., Gainesville—M. W. Smith, P. O. Box 388, M. W. Smith, Purch. Agt.—internal and external grinders.

W. Va., Huntington—The West Virginia Fdry. & Stove Co., 17th St. and 1st Ave., F. C. Boggess, Mgr.—tumbling mill.

O., Columbus—Union Boiler Wks., 57 South Center St., J. J. Borger, owner—machinery for proposed plant on West Goodall St.

Wis., Luck—A. Jacobson and D. Crawford—machinery for auto repair work.

Wis., Milwaukee—J. Biedrzycki, 684 3rd Ave.—lathe 16 in. swing, for garage use.

Wis., Milwaukee—Junek Bros., 3022 North Ave., plumbers, J. Junek, Purch. Agt.—pipe cutters and threader.

Wis., Milwaukee—Razor Blade Knife Co., 1504 First Natl. Bank Bldg., P. R. Newcomb, Purch. Agt.—machine tools to manufacture knives.

Wis., Milwaukee—U. S. Auto Radiator Co., 185 4th St., M. Wald, Purch. Agt.—one 30 in. tinners' folder.

Ia., Dubuque—Bd. Educ., c/o N. Palen, Secy., Bank and Insurance Bldg.—manual training equipment for proposed high school.

Mo., Joplin—Joplin Iron and Metal Co., B and May Sts.—tools for cutting scrap iron.

Tex., Lockhart—W. K. Harris, P. O. Box 651, manufacturers of patented mechanical device, W. K. Harris, Purch. Agt.—Die press to produce parts from metal about ⅛ in. thick, using dies and formers as large as 12 in. square.

Thirty-nine dies and formers from ¾ in. wide and 5 in. long to 9 in. wide and 11 in. long, to cut and form metal parts from sheet metal about ¼ in. thick.

One ¾ in. and one ¾ in. steel rod, uniform in size, smoothly finished for use as shafts.

Cranks with ¾ in. bore, 6 or 6½ in. radius, equipped with nicely finished wood, fiber or vulcanized rubber rotating handle.

Automatic enameling equipment.

Cal., Los Angeles—Union Bank & Trust Co., Garland Bldg.—equipment for auto service station on South Main and Adams Sts.

Man., Winnipeg—The Winnipeg Public School Bd.—equipment for workshops of the Daniel McIntyre College on Alverstone and Wellington Sts.

Pa., Philadelphia—The Hancock Coal Co., 1330 Belmont Ave.—one 46 or 48 in. circular rip saw.

S. C., Anderson—Masters Welding Shop, C. F. Masters, owner—complete welding equipment.

W. Va., Fairmont—Marion Constr. Co., 214 Professional Bldg.—complete machinery for wood-working plant.

Mich., Ironwood—Peninsula Granite Co.—granite and marble working machinery.

O., Cincinnati—Hyde Park Dairy Co., 3755 Edwards Rd.—ice machine.

Wis., Eagle River—Wisconsin-Michigan Lumber Co., E. W. Ellis, Mgr.—planing mill machinery.

Wis., Milwaukee—The Amer. Metal Products Co., Burnham St. and 3rd Ave., O. Staal, Purch. Agt.—light traveling crane.

Wis., Milwaukee—Weimer Welding Co., 252 5th St.—one spot welder.

Wis., Oconomowoc—E. O. E. Otto—rip saw, band saw and jointer for wood working shop.

Mo., Clinton—A. W. Vanderford—machinery for refrigerating plant near Weaubleau.

Ont., Hamilton—The Bd. Educ., R. H. Foster, Secy.—Machinery for technical school.

Metal Working Shops

NEW ENGLAND STATES

Conn., East Hartford (Hartford P. O.)—D. A. Miner, 7 Spruce St., Hartford, has awarded the contract for the construction of a 1 story, 100 x 150 ft. garage and service station, on Conn., Blvd., here. Estimated cost, $65,000.

Conn., Hartford—L. & H. Motors Co., 98 High St., has awarded the contract for the construction of a 2 story, 32 x 90 ft. addition to its garage on High St.

Conn., Hartford—The Prospect Garage, 585 Prospect Ave., has awarded the contract for the construction of a 2 story, 50 x 90 ft. addition to garage.

Mass., Everett—The Builders Iron & Steel Co., Garvey St., has awarded the contract for the construction of a 1 story plant. Estimated cost, $75,000.

Mass., Holyoke—J. F. Cleary, Jr., 112 Maple St., has awarded the contract for the construction of a 1 story machine shop on Maple St. Estimated cost, $15,000.

N. H., Concord—The Boston & Maine R.R. Co., North Sta., Boston, has awarded the contract for the construction of a 1 and 2 story roundhouse on Hall St., here. Estimated cost, $200,000.

Pa., Philadelphia—S. Alexander, c/o I. W. Levine, Archt., Victory Bldg., is having plans prepared and soon receives bids for the construction of a 2 story, 48 x 132 ft. garage and hall, on 4th and Seigel Sts. Estimated cost, $80,000.

Pa., Philadelphia—The Hurley Motor Co., 219 Broad St., has awarded the contract for the construction of a 10 story, 80 x 100 ft. sales and service station. Estimated cost, $350,000.

Pa., Philadelphia—L. Rubin, c/o Neubaurer & Supowitz, Archts., 929 Chestnut St., has awarded the contract for the construction of a 1 story, 97 x 200 ft. garage on 41st and Poplar Sts. Estimated cost, $90,000. Noted June 30.

SOUTHERN STATES

Ala., Birmingham—The Jaffe Iron & Metal Co., 211 North 28th St., plans to construct its 3 story building which was recently destroyed by fire.

MIDDLE WEST STATES

O., Columbus—The Columbus Forge & Iron Co., foot of West 1st St., will receive bids until Aug. 17 for the construction of a 1 story, 70 x 200 ft. and 110 x 123 ft. factory. Estimated cost, $80,000. Brown, Fleming, Knollman & Prior, 233 South High St., Archts. Noted June 2.

O., Columbus—The Union Boiler Wks., 57 South Center St., plans to build a new plant on West Goodall St.

Wis., Milwaukee—The Van Buren Garage Co., 174 Ogden Ave., is having plans prepared for the construction of a 2 story, 60 x 127 ft. garage on Van Buren St. Estimated cost, $75,000. R. E. Oberst, 307 Grand Ave., Archt.

WEST OF THE MISSISSIPPI

Ark., Stamps—The Louisiana & Arkansas Ry. Co. is having plans prepared for the construction of a 1 story locomotive shop. Estimated cost, $150,000. Harrington, Howard & Ash Co., Orear Leslie Bldg., Kansas City, Mo., Archts.

La., New Orleans—Crane Co., 913 West 22nd St., Chicago, Ill., manufacturer of steam fitters supplies, has awarded the contract for the construction of a 5 story, 100 x 160 ft. distributing plant; the main building, sheds and garage will cover 159 x 370 ft., on South Front, Peters, Eratc and Gaunnie Sts. here. Estimated cost $224,778.

THE WEEKLY PRICE GUIDE

This Week's Market

Steel prices remain unchanged in New York markets, with the exception of cold finished steel shafting or screw stock and flats, square and hexagons, which have dropped 20c. per 100 lb. Cleveland reports drop of 15c. in steel shapes, bars, plates and hoop steel; long terne plate quoted at $5.50 as against $6.85.

Tin has advanced from 26¾c. to 27⅜c. per lb. in New York. Copper sheets have been reduced ½c. and solder ½c. per lb. in Cleveland.

Market for shop supplies continues soft, with tendency to sell at least 10 per cent under quoted prices. Although a reduction of ½c. per lb. is shown in certain grades of scrap metals, quotations in these materials are nominal only.

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.80
Northern Basic	25.50
Southern Ohio No. 2	25.52
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	32.26
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25–2.75	27.26
Virginia No. 2	*27.00
Basic	†25.00
Grey Forge	24.40
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	28.67
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	24.96
Basic	23.46
Bessemer	24.96

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Delivered	Cleveland	Chicago Delivered
Structural shapes	$2.88	$2.74	$3.03
Soft steel bars	2.78	2.64	2.93
Soft steel bar shapes	2.78	3.85	2.93
Soft steel bands	3.43		
Tank plates	2.88	2.74	3.03

BAR IRON—Prices per 100 lb. at the places named are as follows:

Mill, Pittsburgh (refined)	$2.50
Warehouse, New York, delivered	2.78
Warehouse, Cleveland	3.52
Warehouse, Chicago	3.13

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York,	Cleveland	Chicago
No. 10	3.10	3.53	3.25	3.68
No. 12	3.15	3.58	3.30	4.18
No. 14	3.20	3.63	3.35	3.78
No. 16	3.30	3.73	3.45	3.88
Black				
Nos. 17 and 21	3.75	4.05	3.80	4.70
Nos. 22 and 24	3.85	4.10	3.85	4.75
No. 25 and 26	3.90	4.15	3.90	4.80
No. 28	4.00	4.25	4.00	4.90
Galvanized				
No. 10 and 11	4.00	4.25	4.00	5.70
No. 12 to 14	4.10	4.35	4.10	5.80
Nos. 17 and 21	4.40	4.65	4.40	6.10
Nos. 22 and 24	4.55	4.80	4.55	5.75
No. 26	4.70	4.95	4.70	5.80
No. 28	5.00	5.25	5.00	5.90

COLD FINISHED STEEL—Warehouse base prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb.	$4.23	$4.63	$4.00
Flats, squares and hexagons, per 100 lb.	4.73	4.63	4.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent
New York	55@60%
Cleveland	55%
Chicago	50%

Electric Welding Wire—Welding wire in 100-lb. lots sells as follows, f.o.b. New York: 5/32, 8½c. per lb.; ¼, 7.15; 5/16 to ½, 6.75. Domestic iron sells at 12c. per lb.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York	Cleveland	Chicago
Openhearth spring steel	5.00	6.50	8.25
Spring steel	8.00	6.50	10.50
Coppered Bessemer rods (base)	8.00	8.00	6.20
Hoop steel	3.88	3.29	3.83
Cold rolled strip steel	7.50	8.25	7.90
Floor plates	4.85	3.09	5.78
Special best cast steel	....	15.00	....

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card of July 7, 1921:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	64½	52	¼ to 1¼	39½	24½

LAP WELD

2	56½	44	2	34½	20½
2½ to 6	60½	48	2½ to 4	37½	24½
7 to 12	57½	44	4½ to 6	37½	24½
13 and 14	45	37	7 to 12	35½	22½
15	42½	32			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	62½	51	1 to 1½	39½	25½
2 to 3	63½	52			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	54½	43	2	35½	22½
2½ to 4	58½	47	2½ to 4	38½	26½
4½ to 6	57½	46	4½ to 6	37½	25½
7 to 8	53½	40	7 to 8	30½	18½
9 to 12	48½	35	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York jobbers' quotations in cents per pound, in quantities up to car lots:

Copper, electrolytic	13@13½
Tin in 5-ton lots	27.37½
Lead	4.75
Zinc	5.00
ST. LOUIS	
Lead	4.35
Zinc	4.60

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York	Cleveland	Chicago
Copper sheets, base	20.50	21.00	23.50
Copper wire (carload lots)	15.50	16.50	19.50
Brass sheets	15.75	18.00	10.75
Brass pipe	16.50	22.00	23.50
Solder (half and half) (case lots)	18.00	20.25	16.50

Copper sheets quoted, above hot rolled 24 oz., cold rolled 14 oz. and heavier. add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are in cents per pound at warehouse:

New York	13.75
Cleveland	16.00
Chicago	18.00

NICKEL AND MONEL METAL—Base prices in cents per pound, any quantities, f.o.b. Bayonne, N. J.

Nickel	
Ingots and shot	41
Electrolytic	44

Monel Metal			
Shot and blocks	35	Hot rolled rods (base)	42
Ingots	38	Cold drawn rods (base)	56
Sheet bars	40	Hot rolled sheets (base)	55

Special Nickel and Alloys	
Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	60
Cold drawn rods, Grade "A" and "C" (base)	72
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods, "D"—low manganese	64
Manganese nickel hot rolled (base) rods "D"—high manganese	67

SHOP MATERIALS & SUPPLIES

ZINC SHEETS—The following prices in cents per pound are f. o. b. mill less 8% for carload lots..... 10.00

	Warehouse	
	In Casks	Broken Lots
New York	11.50	12.00
Cleveland	11.15	11.50
Chicago	15.75	16.25

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

New York	5.25
Chicago	6.00
Cleveland	6.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	9.50	9.50	$10.00
Copper, heavy, and wire	9.00	9.00	8.25
Copper, light, and bottoms	7.00	7.00	7.00
Lead, heavy	3.25	3.50	3.00
Lead, tea	2.00	2.50	2.00
Brass, heavy	5.00	5.00	7.25
Brass, light	4.00	4.00	4.25
No. 1 yellow brass turnings	4.50	4.00	4.50
Zinc	2.50	2.50	2.75

ALUMINUM—The following prices f. o. b. shipping point in cents per pound:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	25.00	25.00@26.00	30.00

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current
New York (round)	19.50
Chicago	23.00
Cleveland	22.00

BABBITT METAL—Warehouse price in cents per pound:

	New York	Cleveland	Chicago
Best grade	70.00	38.50	35.00
Commercial	30.00	13.50	9.00

NOTE—Price of babbitt metal is governed largely by formula, no two manufacturers quoting the same prices. For example, in New York, we quote the best two grades, although lower grades may be obtained at much lower prices.

SHOP SUPPLIES

This market is very soft, and our quotations for the present are useful only as a guide.

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York	Cleveland	Chicago
Hot pressed square	2.00	$2.25	3.00
Hot pressed hexagon	2.00	2.25	3.00
Cold punched hexagon	1.50	2.25	3.00
Cold punched square	1.50	2.25	3.00

Semi-finished nuts, $\frac{7}{16}$ and smaller, sell at the following discounts from list price:

	Current
New York	75%
Chicago	50%
Cleveland	80%

MACHINE BOLTS—Warehouse, discounts in the following cities:

	New York	Cleveland	Chicago
All sizes up to 1 by 30 in	50%	60-10%	50-5%
1¼ and 1½ in. by 3 in. up to 12 in	40%	50-5%	45%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York..... $3.00 Cleveland..... $4.50 Chicago..... $4.00
For cast-iron washers, ¾ and larger, the base price per 100 lb. is as follows:
New York..... $4.25 Cleveland..... $3.75 Chicago..... $4.00

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
¾ by 6 in. and smaller	50%	60%	55%
Larger and longer up to 1 in. by 30 in.	45%	50-10%	50-5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets	Burs
Cleveland	40-10%	10%
Chicago	net	net
New York	50-10%	25-10%

RIVETS—The following discounts are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ½ and smaller	50-10%	60-10%	45%
Tinned	50-10%	60-10%	30%

Structural, ¾, ⅞, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$4.40 Cleveland...$3.90 Chicago....$4.88 Pittsburgh..$2.65
Boiler, same sizes:
New York...$4.50 Cleveland...$4.00 Chicago....$4.98 Pittsburgh..$2.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	19.00	24.00	25.50
Brass	16.50	22.00	24.50

Prices vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb., but not less than 50 lb., 2½c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 5c. should be added to base price; quantities less than 25 lb. add 10c. per lb.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ¼-2 in., inclusive in rounds, and ¼-1½ in., inclusive in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $0.75.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $7.70 per 100 lb. In Cleveland—$5.50 per 100 lb.; New York price is $7.50.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	Cleveland	Chicago
White	7.50@10.00	8.50@11.00	11.00
Colored mixed	5.50@ 9.00	6.50@10.00	10.00

WIPING CLOTHS—Jobbers' price per 1,000 is as follows:

	13½x13½	13½x20½
Cleveland	$55.00	$65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.10
Philadelphia (5 bbl)	1.85
Cleveland	3.00
Chicago	2.50

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current
New York (5 bbl.)	$2.55
Philadelphia (5 bbl.)	2.55
Chicago	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Current
Prompt furnace	$2.90@$3.00
Prompt foundry	4.00@ 4.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	100-lb. bag	$0.80
Cleveland	100-lb. bag	0.80

LINSEED OIL—These prices are per gallon:

	Current		
	New York	Cleveland	Chicago
Raw in barrels (5 bbl. lots)	$0.80	$0.83	$0.87
5-gal. cans	.83*	.98	1.12

*Charge of $2.25 for two cans.

WHITE AND RED LEAD—Base price per pound:

	Current		
	Red		White
	Dry	In Oil	Dry and In Oil
100 lb. keg	12.25	13.75	12.25
25 and 50-lb. kegs	12.50	14.00	12.50
12½-lb. keg	12.75	14.25	12.75
5-lb. cans	15.25	16.75	15.25
1-lb. cans	17.25	18.75	17.25

500-lb. lots less 10% discount; 2,000-lb. lots less 10-4% discount; 10,000 lb. lots less 10-7½% discount. Business is good in white lead.

Minn., Duluth—The Duluth Auto Exch. Co., 201 East 1st St., has had plans prepared for the construction of a 2 story, 100 x 140 ft. garage. Estimated cost, $65,000. A. Rose, 500 Builders Exch. Bldg., Minneapolis, Archt.

Mo., Joplin—The Joplin Iron and Metal Co., B and May Sts. plans to build a 1 story iron plant on West A St. Estimated cost, $25,000. Private plans.

Mo., Kansas City—M. D. Woodling, Reliance Bldg., has awarded the contract for the construction of a 10 story, 100 x 124 ft. garage at 1219 Wyandotte St. Estimated cost, $600,000.

Mo., St. Louis—The St. Charles Garage Co., c/o T. S. Kirkpatrick, 5510 Cates Ave., is having plans prepared for the construction of a 4 story, 130 x 160 ft. garage on St. Charles and 11th Sts. Estimated cost, $350,000. N. B. Howard, Arcade Bldg., Archt.

WESTERN STATES

Cal., Los Angeles—The Oil Well Equipment Co., c/o La Barr & Noyes, Archts., 524 West 9th St., has awarded the contract for the construction of a 50 x 80 ft. factory on 50th and Santa Fe Sts., for the manufacture of oil well supplies. Estimated cost, $10,000.

Cal., Los Angeles—The Union Bank & Trust Co., Garland Bldg., has awarded the contract for the construction of a 1 story, 123 x 139 ft. auto service station on South Main and Adams Sts. Estimated cost, $40,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Ansonia—The Ansonia Electric Co., 55 Main St., has awarded the contract for the construction of a 2 story, 60 x 200 ft. factory. Estimated cost, $250,000. Noted June 23.

Conn., Hartford—The City, Health and Charity Dept., has awarded the contract for the construction of a 2 story, 43 x 63 ft. laundry and heating plant on Holcomb St. Noted July 21.

Conn., Hartford—Case, Lockwood & Brainerd Co., 141 Pearl St., is having plans prepared for the construction of a printing plant. Lockwood, Greene & Co., 60 Federal St., Boston, Mass., Archts. and Engrs.

Conn., Hartford—The Graphic Arts Co., 74 Union Pl., has awarded the contract for the construction of a 3 story, 60 x 82 ft. printing plant on High St. Estimated cost, $75,000.

Conn., Middletown—The Forest City Laundry Co., 56 Hamlin St., has awarded the contract for the construction of a 1 story, 40 x 100 ft. laundry on William St. Estimated cost, $20,000. Noted June 23.

Conn., New Britain—J. Niedzwiki, 215 Farmington Ave., has awarded the contract for the construction of a 2 story, 45 x 65 ft. bakery on Farmington Ave. Estimated cost, $30,000.

Conn., New Haven—C. W. Murdock, Inc., 505 Grand Ave., has awarded the contract for the construction of a 1 story, 55 x 160 ft. trimming mill on Grand Ave. Estimated cost, $15,000.

Me., Gardner—Lockwood, Greene & Co., Archts. and Engrs., 60 Federal St., Boston, Mass., are receiving bids for the construction of a 3 story addition to shoe factory, for R. P. Hazzard Co., 421 Water St. Estimated cost between $60,000 and $70,000.

Mass., Gardner—The Gardner Reed & Rattan Co., 322 Pleasant St., has awarded the contract for the construction of a 2 story, 40 x 70 ft. factory on West Bway. Estimated cost, $10,000.

Mass., Malden (Boston P. O.)— Potter Drug & Chemical Corp., is having plans prepared for the construction of a 2 story, 50 x 85 ft. factory. Estimated cost, $40,000. Lawrence & Wambolt, 6 Beacon St., Boston, Archts.

Mass., Shirely—The State Industrial School will soon award the contract for the construction of a 1 and 2 story, 35 x 140 ft. kitchen and laundry building. Estimated cost, $65,000. Densmore & Le Clear, 88 Broad St., Boson, Engrs.

Mass., Waltham—The Waltham Bleachery will build a 1 story, 70 x 115 ft. plant. Estimated cost, $30,000. Private plans.

N. H., Seabrook—The Atlantic Bldg. Assn. has awarded the contract for the construction of a 3 story, 40 x 170 ft. shoe factory. Estimated cost, $75,000.

R. I., Providence—The Ward Baking Co., 461 Eddy St., has awarded the contract for the construction of a 2 story, 50 x 115 ft. addition to its bakery. Estimated cost, $50,000. Noted Jan. 20.

R. I., West Warwick—The Pawtucket Valley Dyeing Co., Phenix, has awarded the contract for the construction of a 1 story, 50 x 900 ft. dye house, here. Estimated cost, $75,000.

MIDDLE ATLANTIC STATES

N. Y., New York—P. Lorillard Co., 119 West 40th St., manufacturer of tobacco, has awarded the contract for the construction of a 4 story factory on Ave. A. and 72d St. Estimated cost, $500,000. Noted July 7.

Pa., Philadelphia—A. T. Abbott & Co., Berkley Ave., has awarded the contract for the construction of a 5 story, 73 x 170 ft. textile mill on 23d St. and Allegheny Ave. Estimated cost, $100,000. Noted July 28.

Pa., Philadelphia—The Brighton Worsted Co., Tioga and D Sts., has had plans prepared for the construction of a 3 story, 32½ x 55 ft. factory. Estimated cost, $60,000. Private plans.

Pa., Philadelphia — The Logan Baking Co., c/o T. F. Miller, Archt., 1012 Walnut St., is having preliminary sketches made for the construction of a 3 story bakery and power plant in Logan section.

Pa., Uniontown—The Uniontown Hospital has awarded the contract for the construction of a 2 story, 30 x 50 ft. laundry and boiler house. Estimated cost, $35,000.

SOUTHERN STATES

Fla., Lake City—Treasury Dept., Wash., D. C., will receive bids until Aug. 30 for the construction of a laundry and refrigerating plant, etc., at the United States Pub. Health Serv. Hospital, here. J. A. Wetmore, Supervising Archt.

MIDDLE WEST STATES

Ill., Joliet—Zimmerman, Saxie & Zimmerman, Archts., 64 East Van Buren St., Chicago, will receive bids until Aug. 15 for the construction of a 2 story, 47 x 64 ft. manufacturing plant for the Coal Products Mfg. Co. Estimated cost, $75,000.

Ill., Niles (Chicago P. O.)—St. Hedwigs Industrial School for Girls has awarded the contract for the construction of a 2 story printery and infirmary. Estimated cost, $150,000. Noted July 14.

O., Canton — The Canton Oxygen Co., recently incorporated with $200,000 capital stock, plans to build a 2 story factory on Louisville Rd. Estimated cost, $50,000. W. Stolzenbach, Official.

O., Cincinnati—The Hyde Park Dairy Co., 3755 Edwards Rd., is receiving bids for the construction of a 2 story, 32 x 85 ft. dairy. Estimated cost, $40,000. H. W. Voelz, 86 Michigan St., Milwaukee, Wis., Archt. Noted June 25.

O., Cleveland—J. A. Moffet Co., 4539 Hough Ave., (Millwork) plans to build a 1 story, 40 x 60 ft. addition to factory. Estimated cost, $10,000. Private plans.

O., Cleveland — The Tinker Concrete Vault Co., 1700 Urbana Rd., will build a 1 story, 44 x 100 ft. addition to its factory. Estimated cost, $10,000. Private plans.

O., Kenmore—The Palmer Match Co., recently incorporated with $600,000 capital stock, has purchased a site, and plans to build a match factory. Estimated cost, $500,000. C. H. Palmer, Official.

O., Troy—J. Stickel, Market St., plans to build a 2 story ice plant, 20 tons daily capacity. Estimated cost, $50,000. Private plans.

Wis., Green Bay—The Investment Corp., c/o L. M. Hansen Co., 113 West Walnut St., has awarded the contract for the construction of a 4 story, 100 x 200 ft. cold storage plant. Estimated cost between $75,000 and $100,000.

WEST OF THE MISSISSIPPI

Ia., Ames—C. J. O'Neal, manufacturer of ice cream, has awarded the contract for the construction of a 2 story, 50 x 120 ft. factory. Estimated cost, $25,000.

Ia., Cedar Rapids—F. A. Buchard is receiving bids for the construction of a 1 story, 70 x 140 ft. laundry. Estimated cost, $35,000. R. R. Mayberry, Granby Bldg., Archt.

Kan., Galena—C. W. Squires will build a rock crushing mill, 225 ton capacity. Estimated cost, $10,000.

Kan., Pittsburg—Fabler Bros. have awarded the contract for the construction of a 1 story, 92 x 94 ft. cold storage plant and warehouse near Bway. Estimated cost, $25,000.

Mo., Springfield—The Welsch Packing Co., has awarded the contract for the construction of a 3 story, 120 x 160 ft. packing plant. Estimated cost, $131,000. Noted May 26.

Mo., St. Louis—The Excelsior Laundry Co., c/o G. P. Shaum, Grand and Belle Sts., has awarded the contract for the construction of a 2 story, 119 x 127 ft. laundry and power plant on Grand and Washington Sts. Estimated cost, $200,000. Noted May 5.

CANADA

Ont., Chatham—The Rennie Seed Co., Richmond St., plans to rebuild its seed elevator which was destroyed by fire. Loss $100,000.

Ont., London—The London District Milk Producers are preparing plans for the construction of a co-operative dairy in East London. Estimated cost, $250,000. Private plans. J. C. Nichol, R. R. 2, Wilton Grove, Pres.

Ont., St. Marys—St. Marys Milling Co. plans to rebuild its mills which were recently destroyed by fire. Estimated loss $150,000. H. L. Rice, Mgr.

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